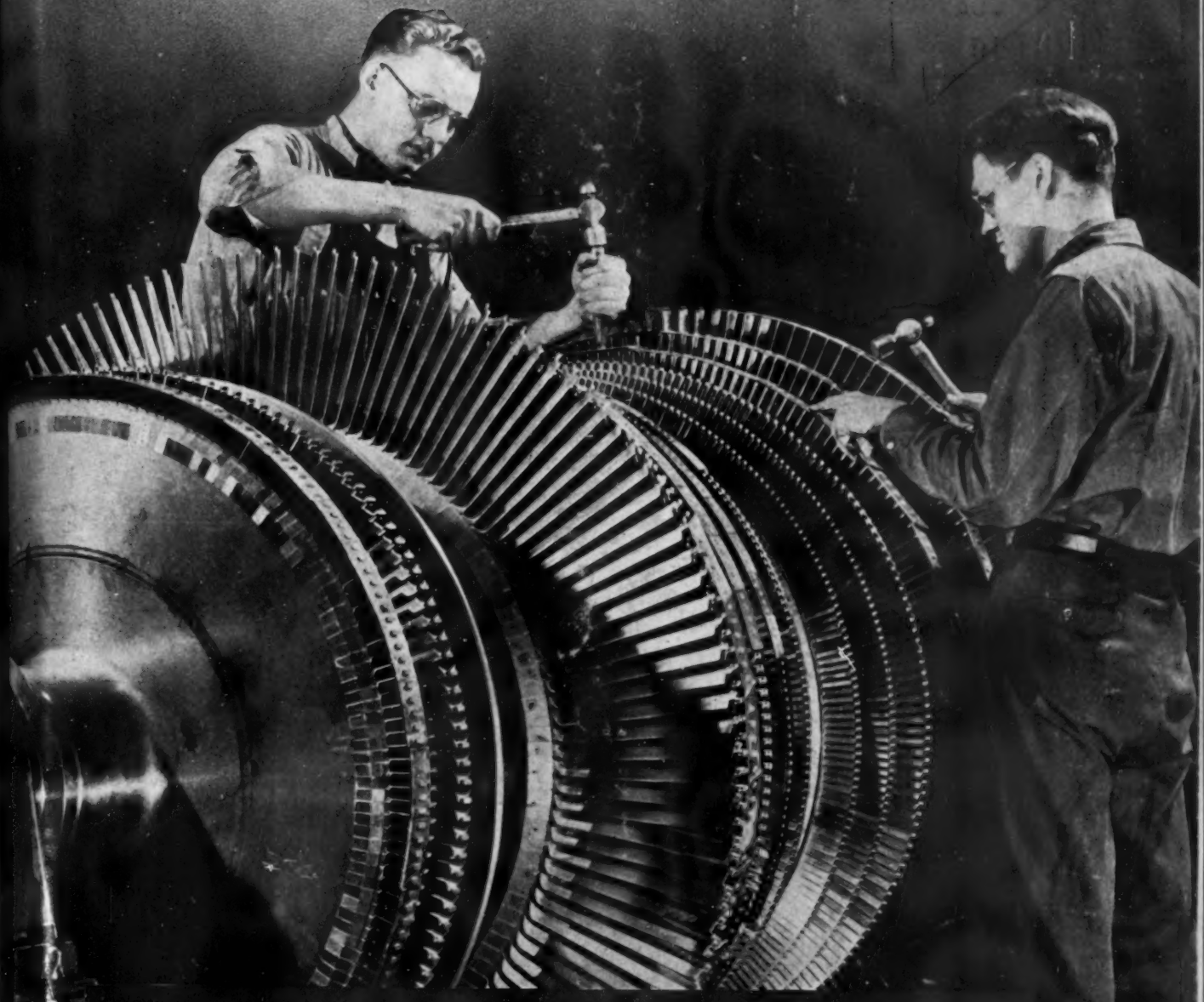
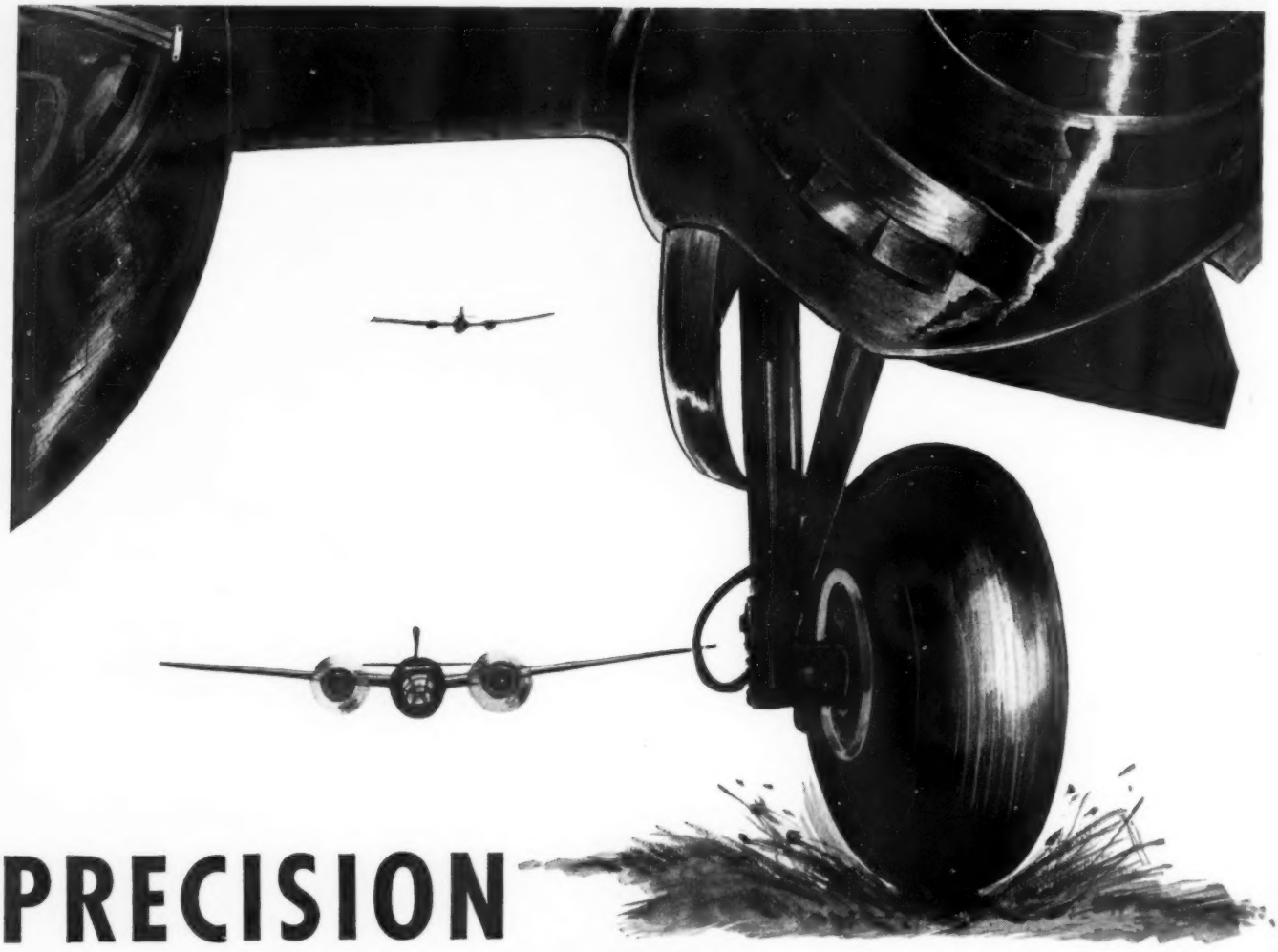
TECHNOLOGY DEPT.

AMERICAN MACHINIST

AUGUST 5, 1943



Broached Blades for Navy Turbines — Page 105

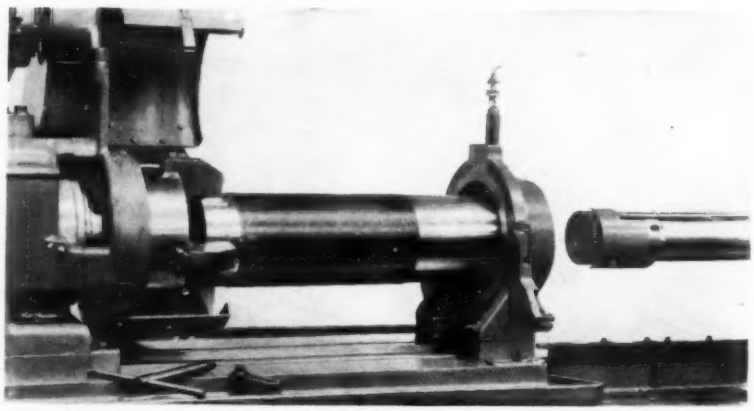


PRECISION

takes the bounce out of Rough Landings

Setting a giant war bird down without a bounce calls for a skillful job of piloting . . . calls for precision manufacture of all landing gear components, too.

By grinding many of the parts on Heald Automatic Grinders, aircraft manufacturers get extreme accuracy in every component. Accuracy that enables the landing gear to cushion the shock of the roughest landing.



Shown above is a Heald No. 74 Extended Bridge Internal grinding big aircraft strut cylinders. A bore 6″ I.D. x 31½″ long is ground in these struts. Strut is held at one end by a four-jaw chuck attached to the workhead and at the other end by a steadyrest, both workhead and steadyrest being mounted on the extended bridge.

However, this is but one of the many Heald precision grinding and boring applications. In the aircraft industry alone, you will find hundreds of Healds boring, grinding, turning, grooving, forming, milling, and facing aeroplane components to the closest tolerances at mass production speeds.

Heald Engineers will gladly help you with your precision grinding and boring jobs. Ask for their services, today.

THE HEALD MACHINE CO., Worcester, Mass., U.S.A.

For More Precision <u>Faster</u>, bring your problems to Heald

TECHNOLOGY DEPT.

American Machinist

August 5, 1943

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AMERICAN MACHINIST —chips

Surprise! . . . If everything has gone according to plan since these words were written, you should be getting this copy of *American Machinist* on or before August 5, the date of issue.

Here's the story: We've just changed printers, involving some changes in our publishing schedule. As you know, delivery of all mail has been greatly retarded by war conditions. To compensate for this your technical journal will be mailed earlier from now on . . . to be exact, on Friday preceding the date of issue.

That means all subscribers in the United States and Canada should receive their copies at least by the issue date . . . . and some will get them before, depending on the distance from New York.

Thus we hope to serve you better and bring you sooner the fortnightly package of helpful technical information that is *American Machinist.*

✪

Spell it "Powder" . . . *Chances are you'll be reading and talking a lot in the days to come about Powder Metals.* (Last covered as leading article, June 24 AM.) *Just thought we'd tell you we have it on the best authority that the common terminology of "Powdered Metals" is wrong. It's "Powder Metals."*

✪

Tomato Wizard . . . The interest of our readers in Victory gardens is certainly widespread enough to warrant this comment: Recently we read with some envy of a Dr. John D. McGavack, who is researching for wild rubber (for U. S. Rubber Co.) among the kok-saghyz, or rubber-yielding Russian dandelion to you.

As a hobby no doubt, Dr. McGavack planted 27 tomato plants on May 15. Place, New Jersey backyard. Nursing them along with a special fertilizer developed at his company's laboratory, as of July 8 he had counted 220 tomatoes on the plants. Some of the fruit then ripening showed promise of weighing more than a pound each.

Don't know about *your* garden, but to us that sounds like pretty hot tomato-growing in any man's league. Must be *some* fertilizer!

✪

Keep 'Em Whirling . . . *Put it down as another big step toward Victory that Armco developed a method of rolling airplane propeller blade steel so that two blades may be made from the same amount of critical material that previously made one. The new process also reduces machining time of the finished propeller by more than one half. Or did you know?*

✪

Meet the Mechlins . . . Comes across our desk a new booklet of the Blackhawk Mfg. Co., Milwaukee. As a light touch it utilizes "Mechlins" (introduced as second cousins of the much publicized "Gremlins") who are portrayed as trouble makers, in various roles, for men who handle wrenches. Antidotes for each "Mechlin" are presented . . . same being, naturally, the proper use of Blackhawk wrenches. Lots of very good ideas are presented and the booklet generally is a swell job. Mailed without charge, by the way, to wrench users and buyers.

✪

Keep 'Em Buying . . . *Our (by this time) familiar friend the poem "Question for Americans" by R. L. Nicholson keeps rolling along through Metal-Working at a lively clip . . . spreading its message of self-sacrifice and patriotism.*

Latest use for this hard-working bit of verse was described to us by a steel products company, who requested an additional quantity of reprints for the following purpose: "Since the Pay-As-You-Go-Tax deduction has started in our plant there have been a number of employees who have asked to have their payroll deduction for war bonds reduced. It is our plan to write a personal letter to these people at their homes and enclose with each letter a copy of this poem. I believe that the poem should be very effective in helping make these people realize the importance of continuing their deductions up to 10% or a better rate. If it doesn't I don't believe there is anything that we could say that would get under their skin."

Amen. We certainly hope this plan works.

✪

Electronics in Industry . . . By now you probably have read General Electric's colorful booklet "Electronics—A New Science for a New World." And pretty soon you may be seeing Westinghouse's new sound movie "Electronics at Work" . . . a most interesting film which we had the pleasure of previewing recently along with others of the industrial press.

The more one gets into the wonders of the electron tube, the clearer it becomes that industrial electronic applications are not rosy dreams of the future; they are here today. Yet we hear that in the past 3 years, 500 million dollars worth of electronic business has been done in industry. In Metal-Working, machine tool controls, welding controls, inspection and measuring apparatus, dielectric heating and induction heating for brazing, annealing, soldering and tempering are just a very, very few of the things that have come to pass. And according to those who should know, the surface of possiblities hasn't even been scratched.

Production executives have two very good reasons for learning some of the practical fundamentals of this new science: One, to be able to confer intelligently on the manufacture of products incorporating electronic principles; two, to keep abreast of new uses for electronic devices on machines and equipment used in the plant itself.

American Machinist editors will be on the alert to bring you helpful, timely information on the subject as it develops.

AVOID DISTORTION WHEN YOU QUENCH

MANY precision parts must be quenched to obtain necessary strength and hardness. An uncontrolled quench, however, results in distortion, which either destroys previously machined accuracy, or necessitates leaving excessive stock to be removed after hardening.

Gleason quenching presses eliminate both of these undesirable conditions by providing a *controlled* quench which holds distortion to a minimum. The principle is simple—the work is held between dies and aligned while still plastic. It is then submerged, and the dies allow normal contraction, while directing the flow of quenching oil so that an absolutely uniform quench is obtained. The rate of quench may be regulated as desired, down to a few seconds per part. An automatic timer returns the work to loading position, assuring uniform length of quench for all parts.—All the operator does is to load the press and push the button.

Manufacturers are finding Gleason presses ideal for a variety of work—gears, discs, lines, bearing cups and cones, —even such parts as crankshafts and breech blocks.

The presses are made in two sizes, 15" and 25", for parts up to these respective diameters. The 25" press can be supplied with a roller fixture attachment for quenching shafts and integral shaft pinions up to 22" length.

Let us show you how a Gleason quenching press can solve your quenching distortion problems. Write for information or, better yet, send prints of the parts you want to quench.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

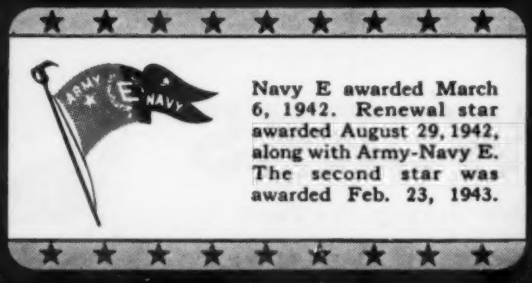
TROUBLED with ABSENTASIA?

We don't claim CINCINNATI Milling Machines will cure Absentasia. But, we do say that if you put men on machines they enjoy running — machines easy to handle — you take a long step forward in the reduction of fatigue, one of the favorite reasons for absenteeism. And real or imaginary, fatigue takes a heavy toll of man hours at a time when they're needed most. ¶ All CINCINNATIS are designed for maximum efficiency and usefulness with a minimum of operator energy — important considerations always, but especially desirable in times like these. The engineers here at Milling Headquarters will be glad to tell you more about it. ¶ Look in Sweet's Catalog File for Mechanical Industries for brief description of all CINCINNATI Machines. Write for complete specification catalog on machine in which you are interested.

A Disease Causing
Intermittent Absence Without Reason

Above: Rough and finish mill gripper edge on cylinder body. The machine is a No. 3 Vertical Dial Type.

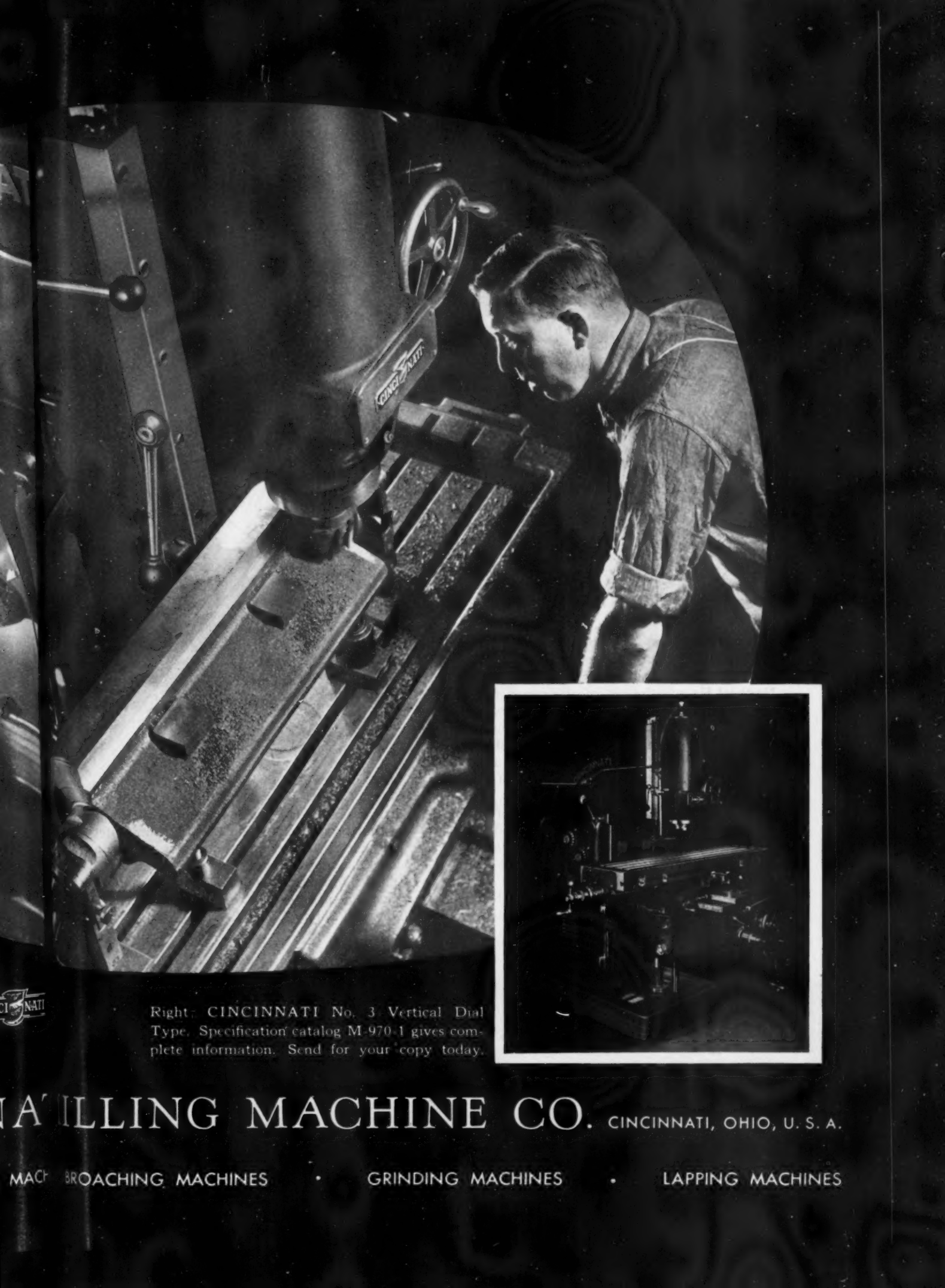
CINCINNATI



Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

THE CINCINNA[TI] IL[LING]

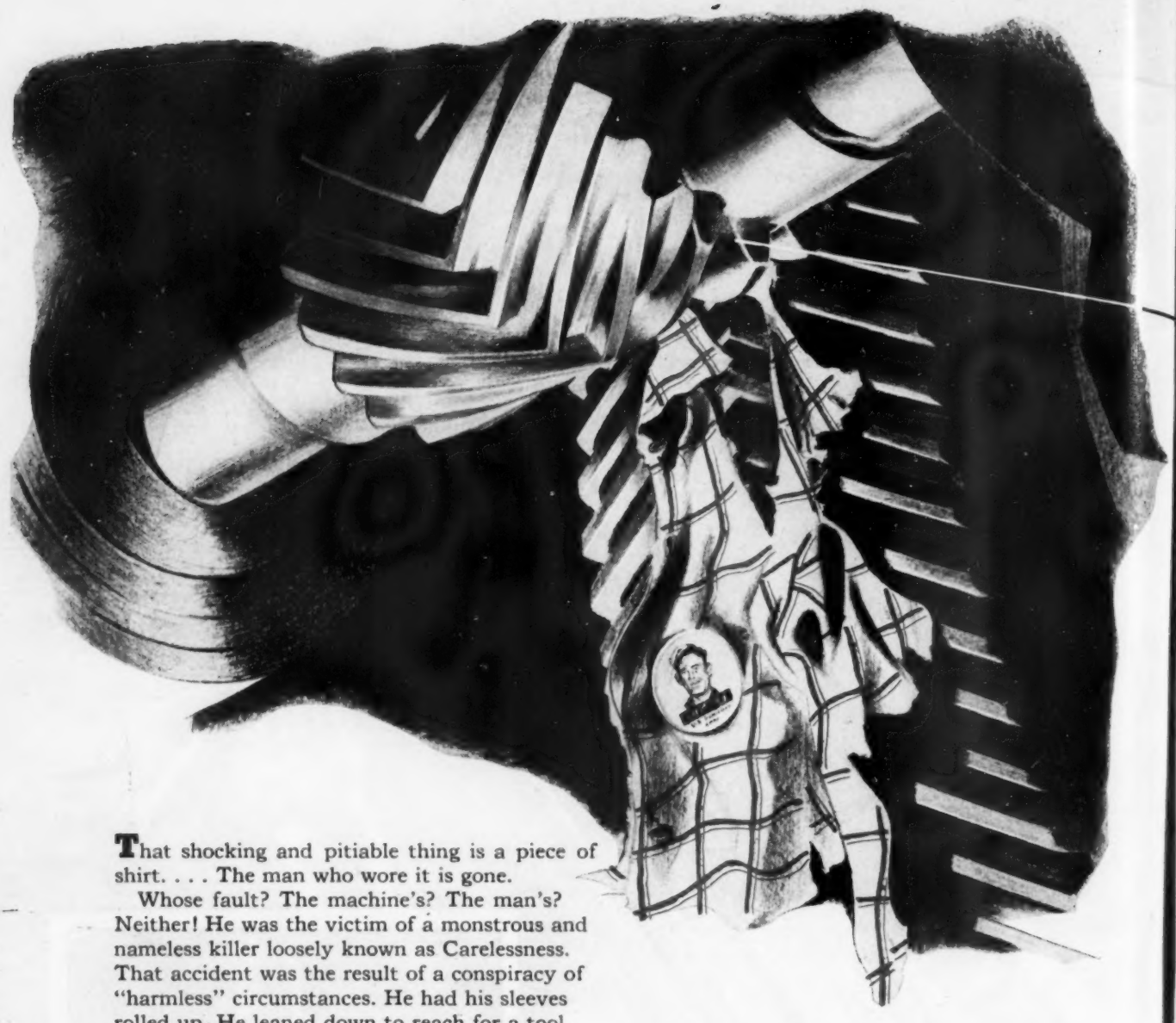
MILLING MAC[HINES] BROA[CHES]



Right: CINCINNATI No. 3 Vertical Dial Type. Specification catalog M-970-1 gives complete information. Send for your copy today.

NA ILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

MACH BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES



That shocking and pitiable thing is a piece of shirt. . . . The man who wore it is gone.

Whose fault? The machine's? The man's? Neither! He was the victim of a monstrous and nameless killer loosely known as Carelessness. That accident was the result of a conspiracy of "harmless" circumstances. He had his sleeves rolled up. He leaned down to reach for a tool. He turned. The gears bit into the roll of his sleeve.

Ghastly? Sure. That's why we speak of it. For last year there were more than 5,000 industrial accidents every day in this country. Nearly 20,000 men were killed at their jobs last year, in the battle we lost with Carelessness.

Yet, this killer can be cornered; and has been in scores of plants. Aroused by our tragic losses in men and manpower, the National Safety Council is directing a major counter-attack against the accident menace. In support of that program, we offer the following Safety Quiz for executives and production men as a check on conditions in your own plant. For detailed information on accident prevention, your government urges you to call upon the National Safety Council.

THE KILLER!

Are there any unrailed grease pits, unguarded gears, exposed belt drives, or unprotected saws and other cutting tools in the plant?

Is there improper lighting and unsafe visual contrast between moving and stationary parts of machines? (Accidents were reduced 75% in one plant by painting non-operating parts white, leaving working parts in their natural metallic lustre.)

Are traveling cranes, straddle trucks and similar moving machines skirted and fendered, brightly painted (yellow is best) and equipped with alarm horns?

Is there any guard against loose material on scaffoldings, and crews working one beneath another?

Are workers' garments checked for loose sleeves, dangling neckties, rings; women workers' hair and heels; correct use of helmets, goggles, safety visors, etc.?

Are new workmen properly instructed about all hazards they may encounter?

JONES & LAMSON

MACHINE COMPANY

Manufacturers of • Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies

Springfield, Vermont, U. S. A.

SADDLE TYPE
UNIVERSAL TURRET LATHES

PROFIT-PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHES

Gears AS

WAR PRODUCTION BULLETIN

In certain devices requiring
TINY GEARS AND PINIONS OF
ZERO BACKLASH PRECISION

Fellows machines produce the requisite quality on a mass production basis... Machines employed are: Gear Shapers, Gear Finishing Machines and Burnishing Machines.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

ACCURATE

AS THEIR USE IS SECRET

Tiny gears and smaller pinions are built into mechanisms whose precision is projected at targets thousands of feet aloft. Lives depend upon their accuracy, and the unimpeded smoothness of their functioning . . . Specifications are as rigid as can be imagined—in fact, they are made with zero backlash. This is a gear job for which the Fellows Method is admirably suited. These gears are cut on the Straight Line Gear Generator, and burnished on the No. 4B Fellows Gear Burnishing Machine. If you are cutting or planning to cut small fine-pitch gears, it will pay you to investigate the possibilities of these machines, for descriptive circulars, write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit, Michigan, or 640 West Town Office Bldg., Chicago, Illinois.

No. 4B Gear Burnishing Machine

Straight-Line Gear Generator

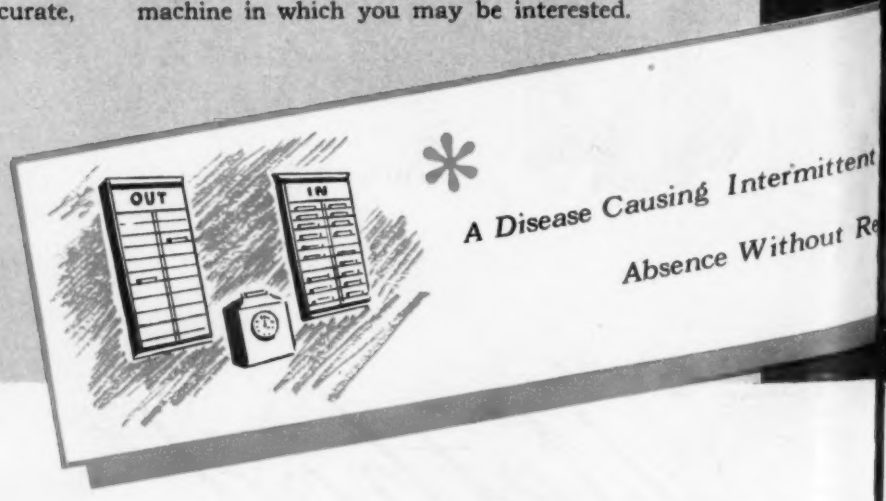
Method

. . . . FROM BLANK TO FINISHED GEAR

Troubled with ABSENTASIA*

War plant representatives list 26 main reasons for absenteeism. Illness caused by fatigue is one of the favorites. Long hours, tiresome jobs, machines hard to handle, operations that require intense concentration, all contribute to fatigue illness. And real or imaginary, this malady is robbing the war effort of many irreplaceable man hours. ¶ But with the engineers here at Grinding Headquarters, the reduction of operator fatigue is of paramount importance, and this group of experts have designed machines that are admittedly easy to handle — that are extremely accurate, and that can be depended upon to turn out work right — work operators are proud of. So, why not by-pass one of the favorite excuses for absenteeism by putting men on grinding machines they enjoy running. Install CINCINNATI Grinding Machines and watch them go to town. ¶ If you have a grinding problem, talk it over with our engineers. Chances are they will have the right answer to your difficulty. ¶ For a brief description of all CINCINNATI Grinders, look in Sweet's Catalog File. Specification catalogs are available on any machine in which you may be interested.

CINCINNATI

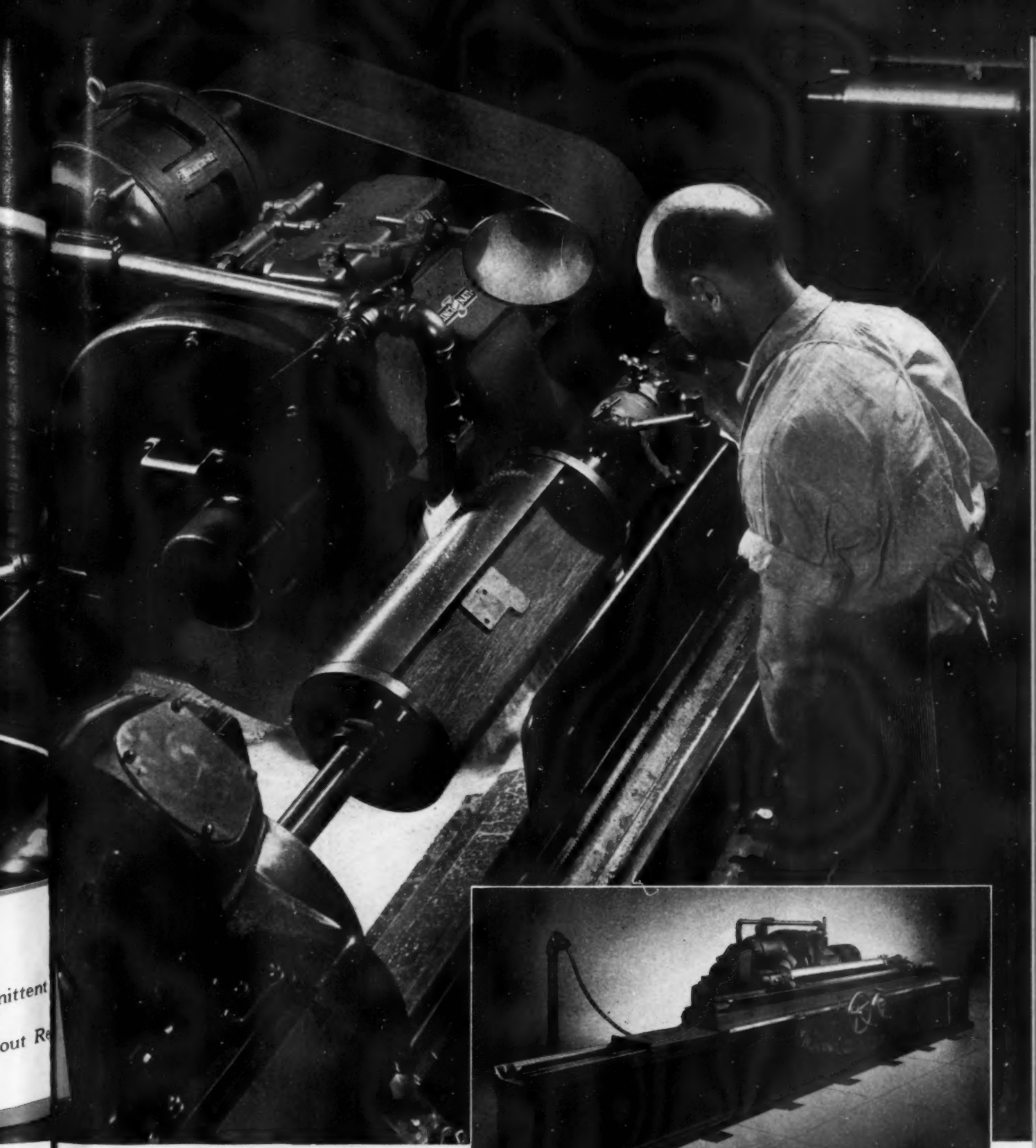


Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

CINCINNATI GR

CINCI

CENTER TYPE GRINDING MACHINES



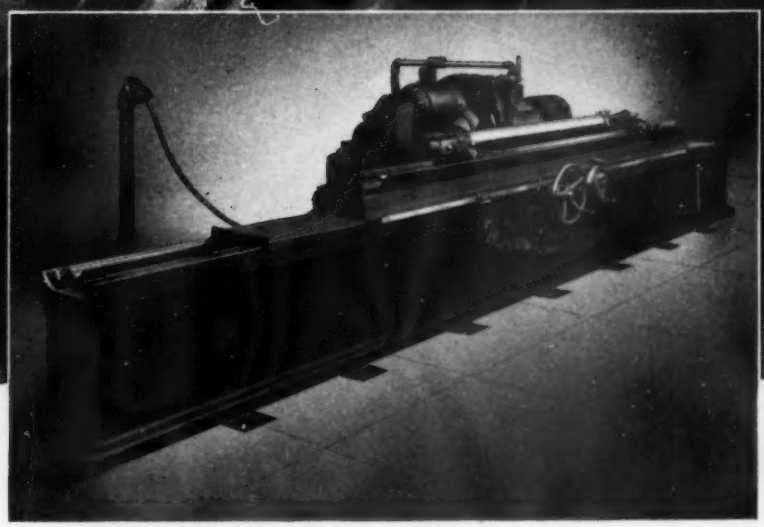


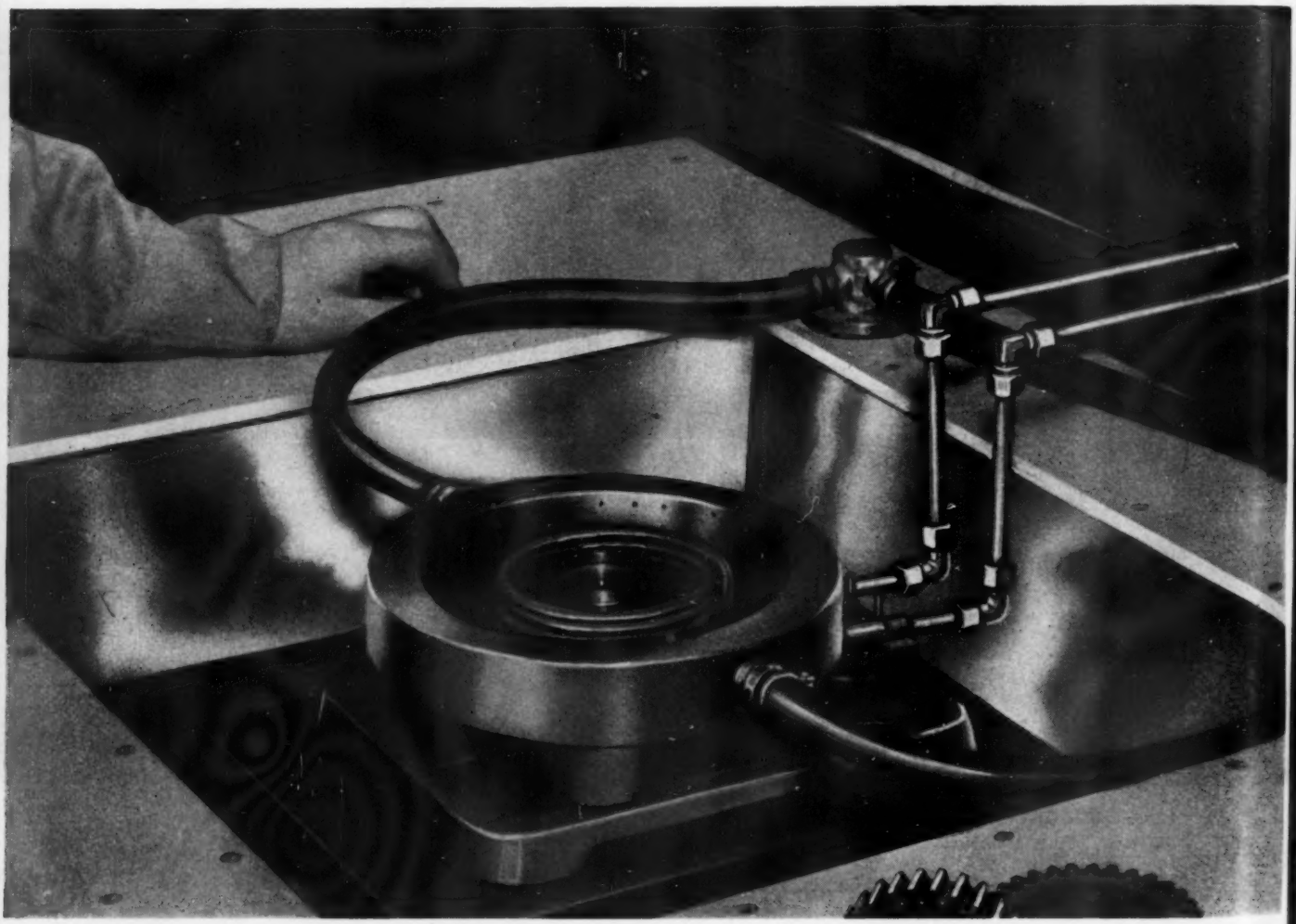
Illustration above: Grinding the outside diameter of a printing press cylinder. At the right is a CINCINNATI Plain Self-Contained Grinding Machine. Catalog G-491 gives complete specifications.

TGRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

HINES NTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

VAN NORMAN



APPLICATIONS: ***Surface Hardening, Brazing, Soldering, Annealing, Forging, Melting***

IT PAYS TO

INDUCT-O*

(*HIGH FREQUENCY INDUCTION HEATING)

Speeds Localized Hardening Operations . . . Cuts Costs . . . Conserves Alloy Steels

Hardening gears, rack teeth, cams, shafts, precision gages, etc. to practically any Rockwell C and predetermined depth is accomplished in seconds on the Van Norman Induct-O. The speed and ease with which the parts are hardened not only simplifies the heating operation but also saves valuable time . . . cuts costs and often makes it possible to conserve alloy steels.

In the illustration, teeth of a two step gear are hardened to Rockwell 52C in 21 seconds. The hardening operation comprises of 12 seconds heat and 9 seconds quench. The gear is heated to 1/16" of tooth profile and hardness penetration is .035" to .045". There is no scale formed during the heating operation and warpage and deformations, often encountered under other heating methods, is eliminated. Since only the teeth have been hardened, there are no internal strains and drawing is unnecessary. And because plain carbon steel, such as X-1340, can be used for most parts previously made of expensive alloy steels, Van Norman High Frequency Induction Heating conserves vital alloys and permits substantial savings in material cost. Typical examples of parts hardened by the Van Norman Induct-O are shown at left.

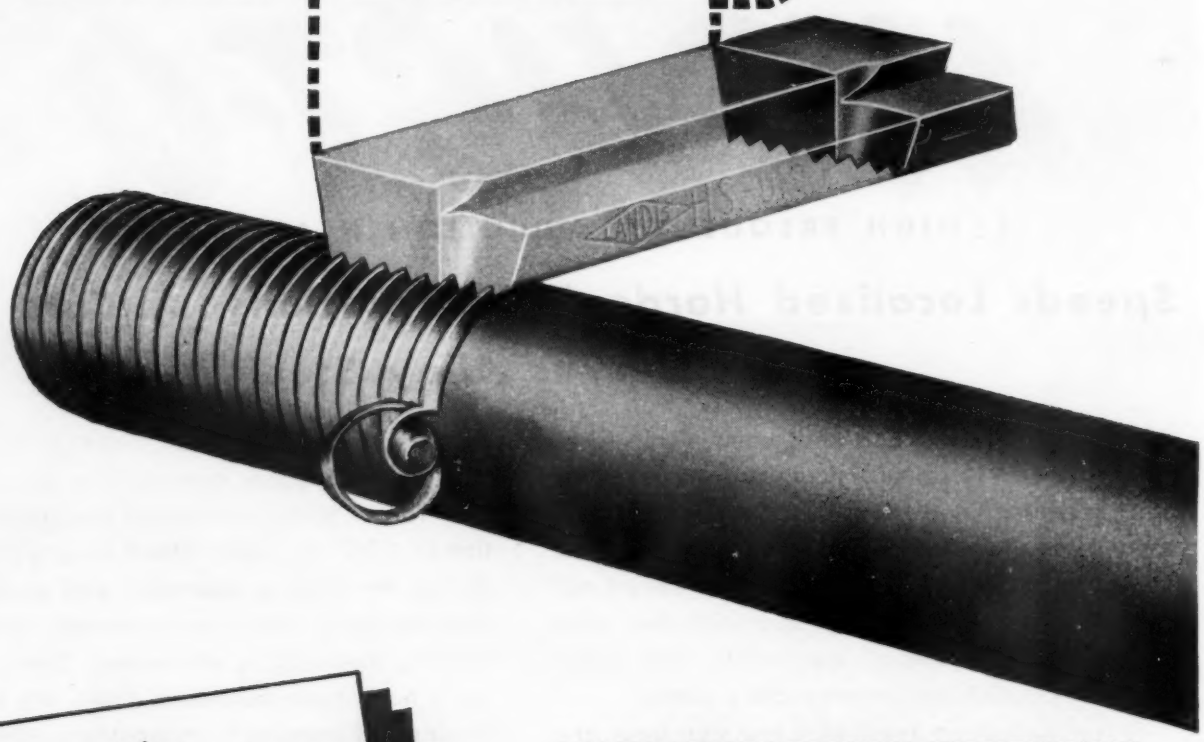
Illustrated are but a few of the wide variety of parts successfully made of plain carbon steel and hardened by the Van Norman Induct-O.

If you have been trying to figure out how to speed up your hardening operations, then investigate the Van Norman Induct-O. Write for bulletin.

VAN NORMAN MACHINE TOOL CO.
ELECTRONICS DIVISION
Springfield, Massachusetts

VAN NORMANIZE

WITH THE LANDIS CHASER APPROXIMATELY 80% OF THE CHASER'S LENGTH IS *USABLE*



12 Features of the LANDIS TANGENTIAL CHASER

1–Permanent throat permits close to shoulder threading throughout life of chasers
2–Rake angle range covers all machinable materials
3–Free cutting condition permits maximum cutting speeds
4–Simple grinding operation renews entire cutting edge and leading feature
5–Line contact with work lessens friction and minimizes thread distortion
6–Leading feature insures thread of accurate lead
7–Lateral absorption of cutting strain reduces vibration and chaser breakage
8–Right and lefthand threading feature reduces chaser equipment
9–Standard chasers thread all diameters with proper chaser holders
10–Interchangeability of chasers lowers operating cost
11–Chaser length provides exceptionally long life and low tool cost
12–Permanent throat gives equal distribution of cut

CHASER LENGTH PROVIDES EXCEPTIONALLY LONG LIFE AND LOW TOOL COST

Since the design of the Landis Chaser makes it possible to regrind approximately 80% of its length, with the cutting edge renewed at each regrinding, it has an exceptionally long life and thereby reduces chaser cost to a minimum. Conservatively estimated, the life of the Landis Chaser is from ten to twenty times that of the hobbed type die.

The Finest Thread Cutting Tool in Industry

LANDIS MACHINE COMPANY

WAYNESBORO, PA., U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

LANDIS REG. U.S. TRADE MARK PAT. OFF.

THREAD TIPS

A Good Mechanic Knows and Cares For His Machine

In the Interest of Efficiency, Better Workmanship and Higher Production

FOR MAXIMUM CHASER LIFE AND BEST QUALITY OF THREAD FINISH, USE THE CORRECT CUTTING SPEED FOR THE MATERIAL BEING THREADED

LANDIS SYSTEM OF THREADING SPEEDS (F.P.M.)

FOR PIPE

MATERIALS						
	MERCHANT PIPE		CAST IRON		COPPER	
					YELLOW BRASS	
DIA.	R. P. M.	SURFACE SPEED	R. P. M.	SURFACE SPEED	R. P. M.	SURFACE SPEED
1/8	377	40	471	50	566	60
1/4	248	35	354		424	
3/8	198		283		338	
1/2	150	33	204	45	250	55
3/4	120		164		200	
1	87	30	116	40	145	50
1-1/4	69		92		115	
1-1/2	60		80		101	
2	48		64		81	
2-1/2	33	25	47	35	60	45
3	27		38		49	
3-1/2	24		33		43	
4	21		30		38	
4-1/2	19		27		30	40

MATERIALS CONT'D						
	MERCHANT PIPE		CAST IRON		COPPER	
					YELLOW BRASS	
DIA.	R. P. M.	SURFACE SPEED	R. P. M.	SURFACE SPEED	R. P. M.	SURFACE SPEED
5	17.2	25	24	35	27	40
6	14.4		20		23	
7	12.5		18		20	
8	11.0		11	25	15.4	35
9	7.9	20	9.9		13.9	
10	7.1		8.9		12.4	
11	6.5		8.1		11.4	
12	6.0		7.5		9.0	30
14	5.5		6.8		8.2	
15	5.1		6.4		7.6	
16	4.3	18	6.0		6.0	25
17	4.0		5.6		5.6	
18	3.8		5.3		5.3	
20	3.4		4.8		4.8	

SPEEDS FOR CAST IRON PIPE BASED ON STANDARD PIPE THREAD DIMENSIONS.

Be Threadwise—Employ LANDIS Long Life Tangential Chasers

LANDIS MACHINE COMPANY
Waynesboro, Penna., U. S. A.

HOBBING A SMALL, ACCURATE GEAR FEATURING FINE FINISH AND QUIET RUNNING ABILITY

ON A BARBER-COLMAN No. 3 HOBBING MACHINE

These illustrations show a close-up of the hobbing operation, and one of the finished pieces, of a shutter gear used in a prominent make of a movie sound projector. No picture could show how quietly this gear runs, nor is it practical to photograph the fine finish and accuracy which makes it so quiet. These important qualities are indicated by sensitive test instruments, but the final test is the satisfaction expressed by thousands of users of the projector, and by its ability to produce clear, brilliant, flickerless movies. A Barber-Colman No. 3 Hobbing Machine is used to generate the teeth on this shutter gear, because this machine has demonstrated its ability to produce gears that must meet exacting specifications. For example, this gear is held to less than .001″ backlash, and a pair of them must roll within .0005″ on pitch diameter as well as rotate freely under any conditions in a gravity feed test instrument. For consistent, high-quality accuracy and finish, on production work, use Barber-Colman Hobbing Machines.

SET-UP OF THIS JOB

Piece — Movie projector shutter gear.

Material — Aluminum alloy.

Dimensions — 1.280″ O.D. .080″ face, 62 teeth, 50 pitch spur form.

Machine Set-up — feed .008″ per rev. of work, hob speed 388 r. p. m. paraffin oil cutting fluid.

Production — approximately 60 gears in 10 hours.

Hob — B-C 1 7/8″ x 1 7/8″ x taper hole. Produced 200 pieces per setting and 1000 pieces per sharpening.

Piece is clamped on special arbor and held between centers.

Note burring tool attachment.

HAND BOOK "L"

How can you get maximum life from hobs? One important factor is proper sharpening, which is thoroughly covered in a special section of the new Barber-Colman Handbook "L", pages 271-282. This book is available when requested on company letterhead signed by person in key position.

Buy War Bonds

BARBER B-C COLMAN PRODUCTS

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

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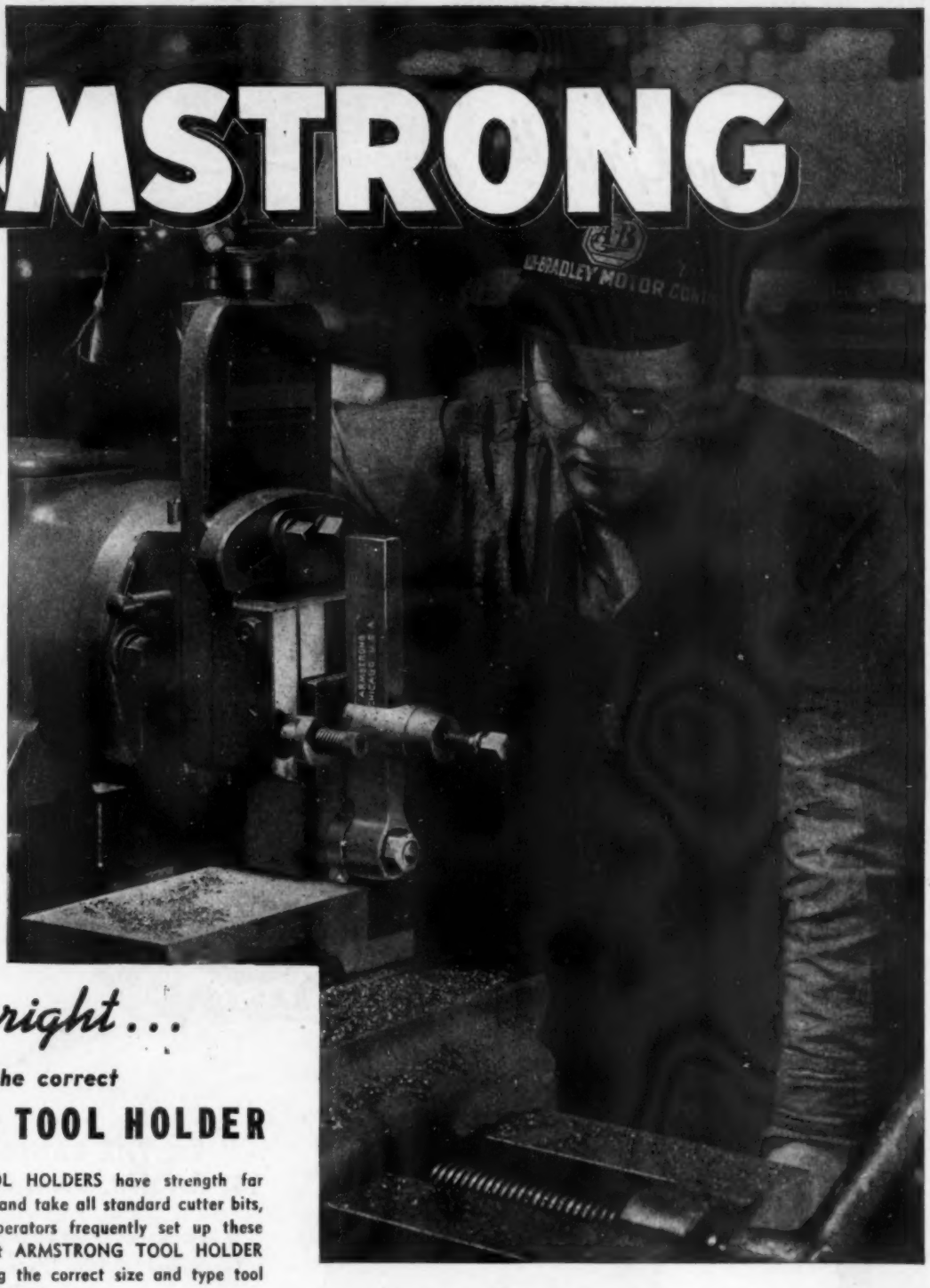
ARMSTRONG



Start right...

with the correct

ARMSTRONG TOOL HOLDER

Because ARMSTRONG TOOL HOLDERS have strength far beyond normal requirements, and take all standard cutter bits, lathe, planer and shaper operators frequently set up these machine tools with the first ARMSTRONG TOOL HOLDER at hand, instead of selecting the correct size and type tool holder for the operation to be performed.

Today with maximum production demanded from every machine tool and man hour, it is important that every operation be *started right*, with the correct ARMSTRONG TOOL HOLDER . . . the tool holder, especially designed for that operation and which holds the cutter at the correct cutting angle, gives the most efficient tool approach, and cuts efficiently even at greatly stepped-up speeds and feeds.

Write for an ARMSTRONG C-39 Catalog today, and check to be sure that you are using the correct ARMSTRONG TOOL HOLDERS for each operation.

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"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.

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Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

George Grindit
Says "Oil them and leave them. That's my attitude toward wheel spindles and bearings. Yes, I know. Sometimes they do need attention. More often than not they get too much."
PRECISION
LANDIS
GRINDERS
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Q-90

THE LANDIS 18" RADIAL CAM GRINDER

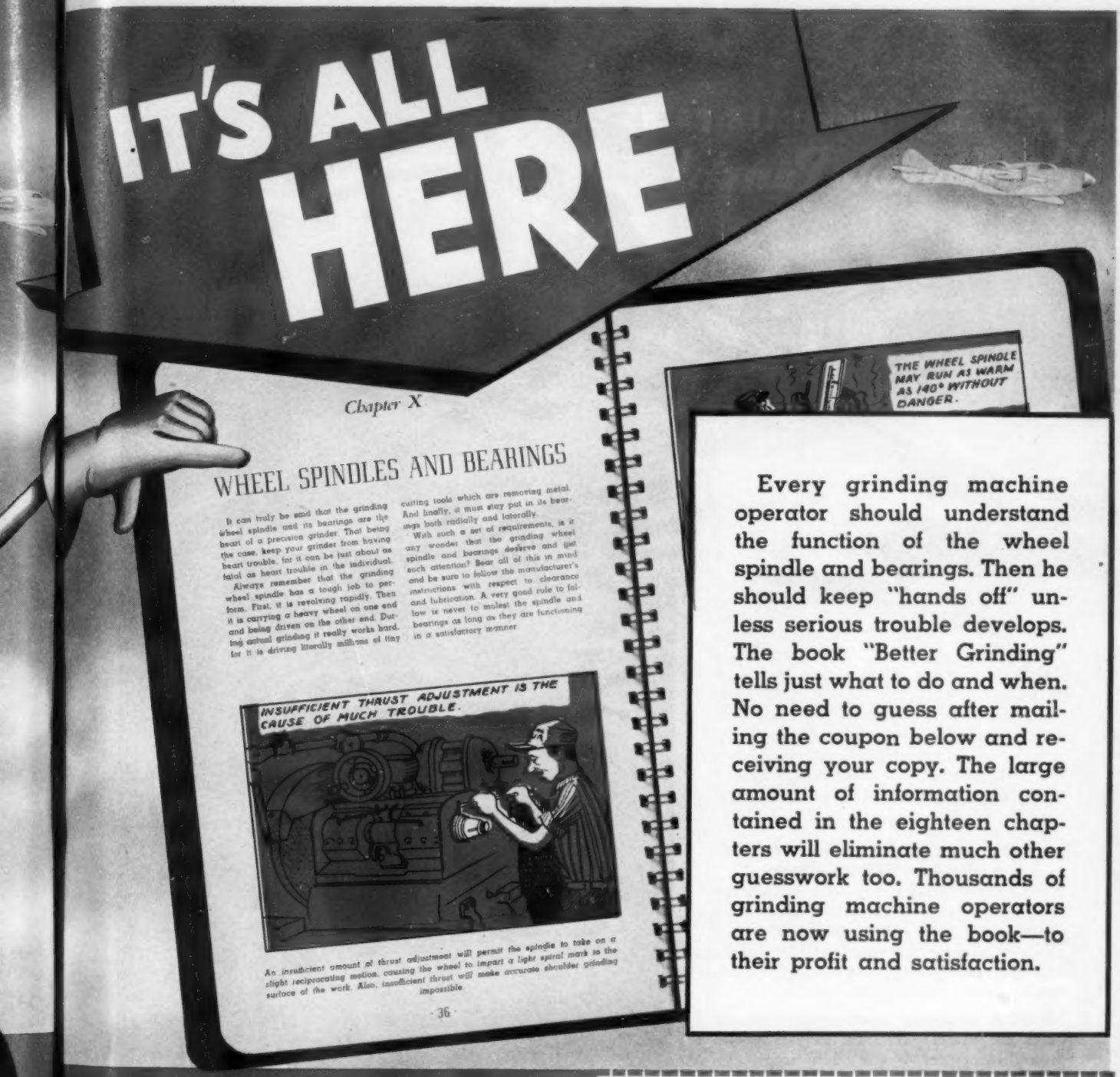
- Recommended for all radial engine cams and certain types of Diesel engine cams.
- Used widely by manufacturers of radial airplane and tank engines.

IF YOU HAVE A GRINDING PROBLEM

Let George do it

LANDIS TOOL COMPANY

IT'S ALL HERE


Chapter X
WHEEL SPINDLES AND BEARINGS
It can truly be said that the grinding wheel spindle and its bearings are the heart of a precision grinder. That being the case, keep your grinder from having heart trouble, for it can be just about as fatal as heart trouble in the individual.
Always remember that the grinding wheel spindle has a tough job to perform. First, it is revolving rapidly. Then it is carrying a heavy wheel on one end and being driven on the other end. During actual grinding it really works hard, for it is driving literally millions of tiny cutting tools which are removing metal. And finally, it must stay put in its bearings both radially and laterally.
With such a set of requirements, is it any wonder that the grinding wheel spindle and bearings deserve and just such attention? Bear all of this in mind and be sure to follow the manufacturer's instructions with respect to clearance and lubrication. A very good rule to follow is never to molest the spindle and bearings as long as they are functioning in a satisfactory manner.
INSUFFICIENT THRUST ADJUSTMENT IS THE CAUSE OF MUCH TROUBLE.
An insufficient amount of thrust adjustment will permit the spindle to take on a slight reciprocating motion, causing the wheel to impart a light spiral mark to the surface of the work. Also, insufficient thrust will make accurate shoulder grinding impossible.
36
THE WHEEL SPINDLE MAY RUN AS WARM AS 140° WITHOUT DANGER.

Every grinding machine operator should understand the function of the wheel spindle and bearings. Then he should keep "hands off" unless serious trouble develops. The book "Better Grinding" tells just what to do and when. No need to guess after mailing the coupon below and receiving your copy. The large amount of information contained in the eighteen chapters will eliminate much other guesswork too. Thousands of grinding machine operators are now using the book—to their profit and satisfaction.

THE CHAPTERS

Work Centers and Centers in the Work . . Work Drivers and Driving Dogs . . Work Rests . . The Diamond . . Wheel Dressing and Wheel Truing . . Mounting and Balancing the Wheel . . Grinding Wheel Coolant . . Lubrication . . Multiple V Belt Drives . . Wheel Spindles and Bearings . . Grinding Wheel Feed . . Grinding Wheel Width . . Speed of Work Carriage Traversal . . Work Speed . . Grinding Wheel Speed . . The Grinding Wheel . . Chatter . . Miscellaneous Bits.

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"BETTER GRINDING"

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COMPANY _____

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Please Print Above and Send To

LANDIS TOOL CO.
WAYNESBORO, PENNSYLVANIA

WAYNESBORO, PENNSYLVANIA

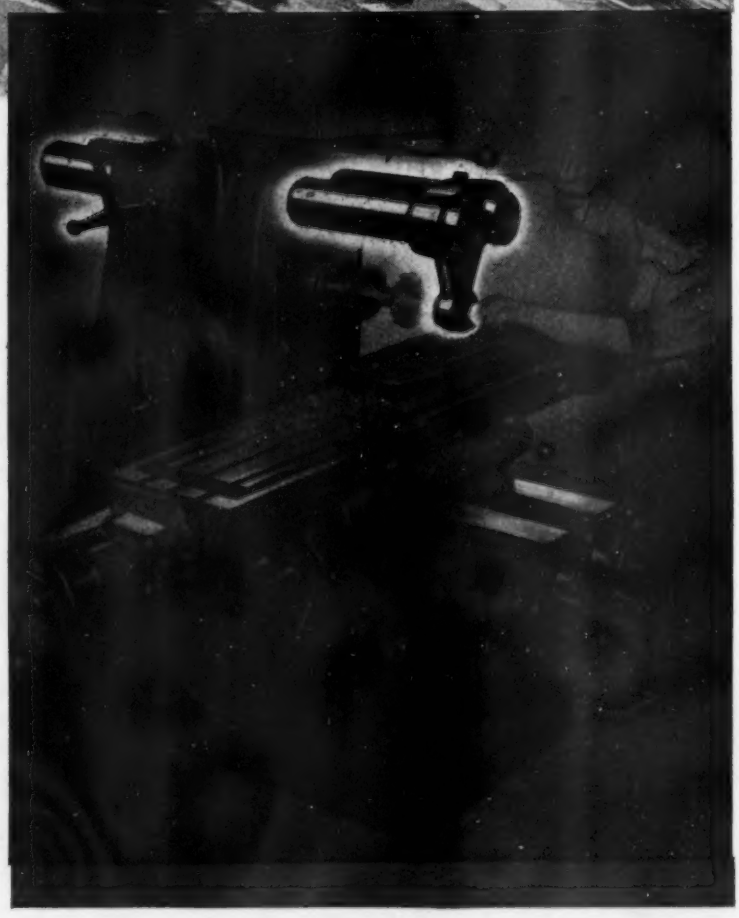
Streaking through the water at speeds of 60 miles an hour, PT Boats pack more speed and hitting power for their size than any other naval craft afloat. Their capacity to deal death and destruction — like a thunderbolt — makes them one of Uncle Sam's most feared killers of the sea.

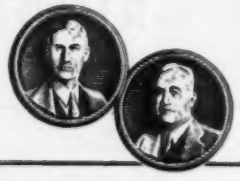
★ ★ ★

Double Over-Arms Provide a DUAL ADVANTAGE in Milwaukee Milling Machines

Rigidity and convenience—the Milwaukee double over-arm — scores heavily on both counts . . . No other means of arbor support is quite the equal of the double over-arm in *rigidity* — an indispensable quality in any milling machine.

No other means of arbor support affords quite the same quick and easy access to the milling cutter — just a few simple motions and both cutter and arbor are free — an important convenience to the operator at all times.





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Buy Victory
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Milwaukee **MACHINE TOOLS**

For *Victory*

and For Your Future...

BUY WAR BONDS AND STAMPS!

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War Bonds and Stamps provide a good way to save for the home you have always wanted to own.

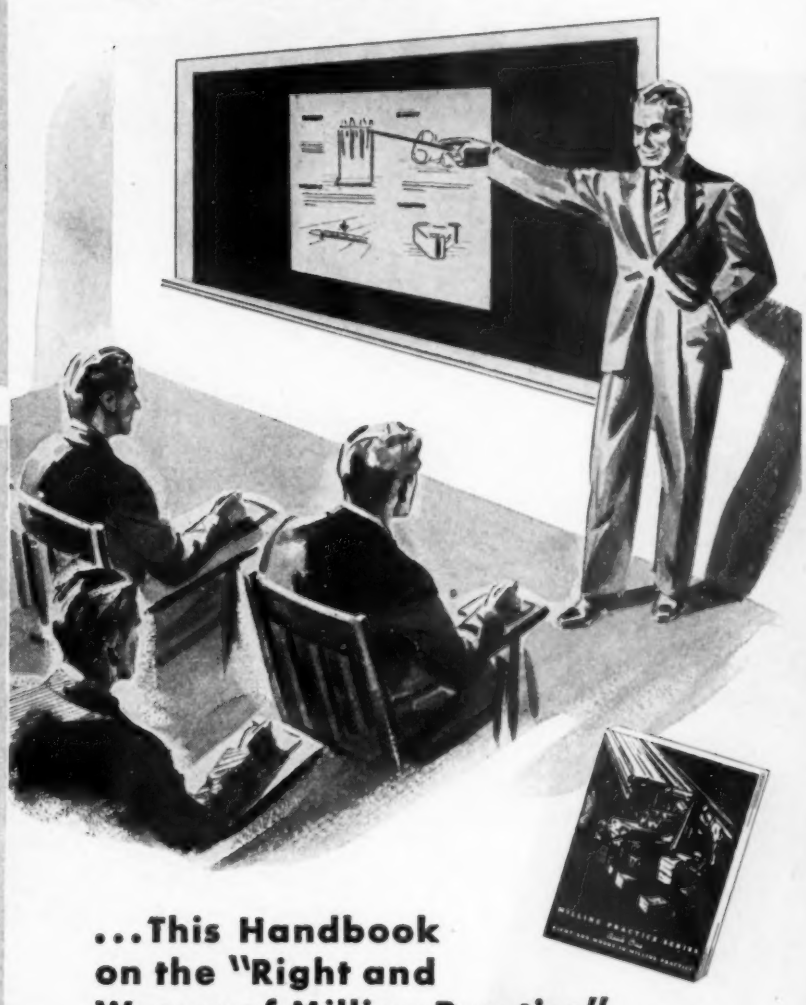
Your Children's Education . . .
War Bonds and Stamps — a good way to lay aside funds for educating your children.

A New Car For Your Family . . .
Save now with War Bonds and Stamps for that new car you will want to buy when the war is over.

'43 FOR VICTORY

Buy VICTORY WITH AT LEAST 10% IN WAR BONDS

JUST LIKE A LECTURE ON THE FUNDAMENTALS OF MILLING...



...This Handbook on the "Right and Wrong of Milling Practice"

Even experienced milling machine operators find this handbook useful and valuable in brushing up on the fundamentals of sound milling practice.

Written in an easy-to-understand style — contains hundreds of illustrations depicting the right and wrong way of operating a milling machine — plus many valuable suggestions on short cuts in milling — and the correct care and attention of the machine.

Write for your personal copy of the newest Kearney & Trecker publication, "The Right and Wrong of Milling Practice".

Kearney & Trecker *Products* CORPORATION
MILWAUKEE, WISCONSIN
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Kearney & Trecker CORPORATION
Milwaukee, Wisconsin

Thank You Mr. Morton...

KOPPERS COMPANY
AMERICAN HAMMERED PISTON RING DIVISION
BALTIMORE · MD.

May 26, 1943

ALLEN W. MORTON
VICE PRESIDENT

Norton Company
Worcester, Mass.

Attention: Mr. Frank W. Smith
Sales Manager

Gentlemen:

Several months ago the American Hammered Piston Ring Division of Koppers Company was awarded the Army-Navy "E" for outstanding production of war materials.

The assistance obtained from the Norton Company organization played a large part in helping us win this award. Had you not met your delivery schedules, we would not have been able to produce our quota of war materials. We are indebted to you for your splendid cooperation, which has placed us among the first of the subcontractors to be honored with the coveted Army-Navy "E". We now have seventy-five of your Hyprolap machines running twenty-four hours a day seven days a week.

Before the war we were perhaps the largest supplier of piston rings to the Army and Navy and Air Forces, but no one factory single handed could begin to produce the rings needed for the aircraft industry alone and we, therefore, invited the other piston ring manufacturers to our plant shortly after the outbreak of the war and showed them our machines and methods for producing aircraft piston rings. Among the important machines have been Norton Hyprolaps, which we understand have now become universal among all the manufacturers of aircraft piston rings and the part played by the Norton Company is significant in this tremendous program.

Again we wish to express our gratitude to your entire organization.

Sincerely,

Allen W. Morton

A.W.Morton...GN

NORTON and

GRINDERGRAM

If grinding coolant appears in the hydraulic oil reservoir, expect trouble. Coolant compound, which will not mix with oil, causes sticky control valves and faulty machine action. Look for leaks in piping, guards or spray deflectors

Teamwork IS Essential

WE MAKE THE HYPROLAPS
YOU MAKE THE PISTON RINGS

Norton HYPROLAPS in the plant of American Hammered Piston Ring Division, Baltimore, Md.

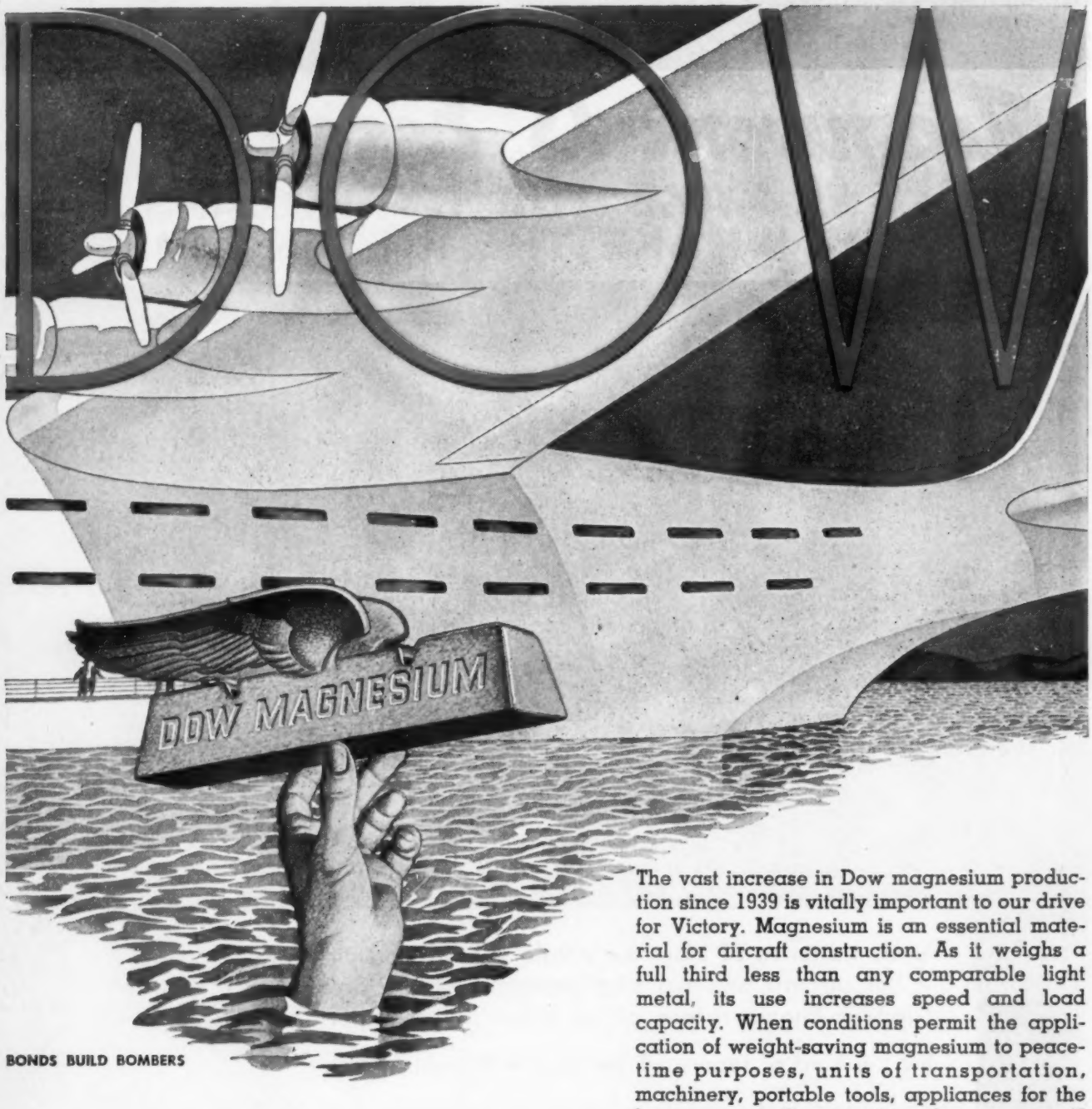
Yes, batteries of Norton Hyprolaps are producing piston rings for the aircraft and the land transport of the armed forces. Norton Lapping Engineers are giving these plants expert assistance.

It's the kind of teamwork needed in this war effort.

And Norton Company pledges to continue that kind of service. Whether Norton Grinding and Lapping machines in *YOUR* plant number into the hundreds or whether you have but a single machine tucked away in a shop corner, Norton Service is available.

NORTON COMPANY, WORCESTER, MASS.

GRINDERS
Lappers



BONDS BUILD BOMBERS

The vast increase in Dow magnesium production since 1939 is vitally important to our drive for Victory. Magnesium is an essential material for aircraft construction. As it weighs a full third less than any comparable light metal, its use increases speed and load capacity. When conditions permit the application of weight-saving magnesium to peacetime purposes, units of transportation, machinery, portable tools, appliances for the home—practically everything that moves—will greatly benefit from the huge production that will then be available to all industries.

DOWMETAL

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

MAGNESIUM

PRODUCER SINCE 1916

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MARVEL SAWS

Mitering a structural angle iron—with a MARVEL No. 8. The blade is fed into the work. Work is held stationary on the bed in quick action vise.

Shipbuilding calls for Universal tools.

There's a lot of sawing — cutting-off, mitering, notching and special cuts wherever ships are being built, and work comes in all sizes too. That's why you'll find MARVEL No. 8 Metal Cutting Band Saws in ship yards and Navy yards, as well as in tool rooms and die shops.

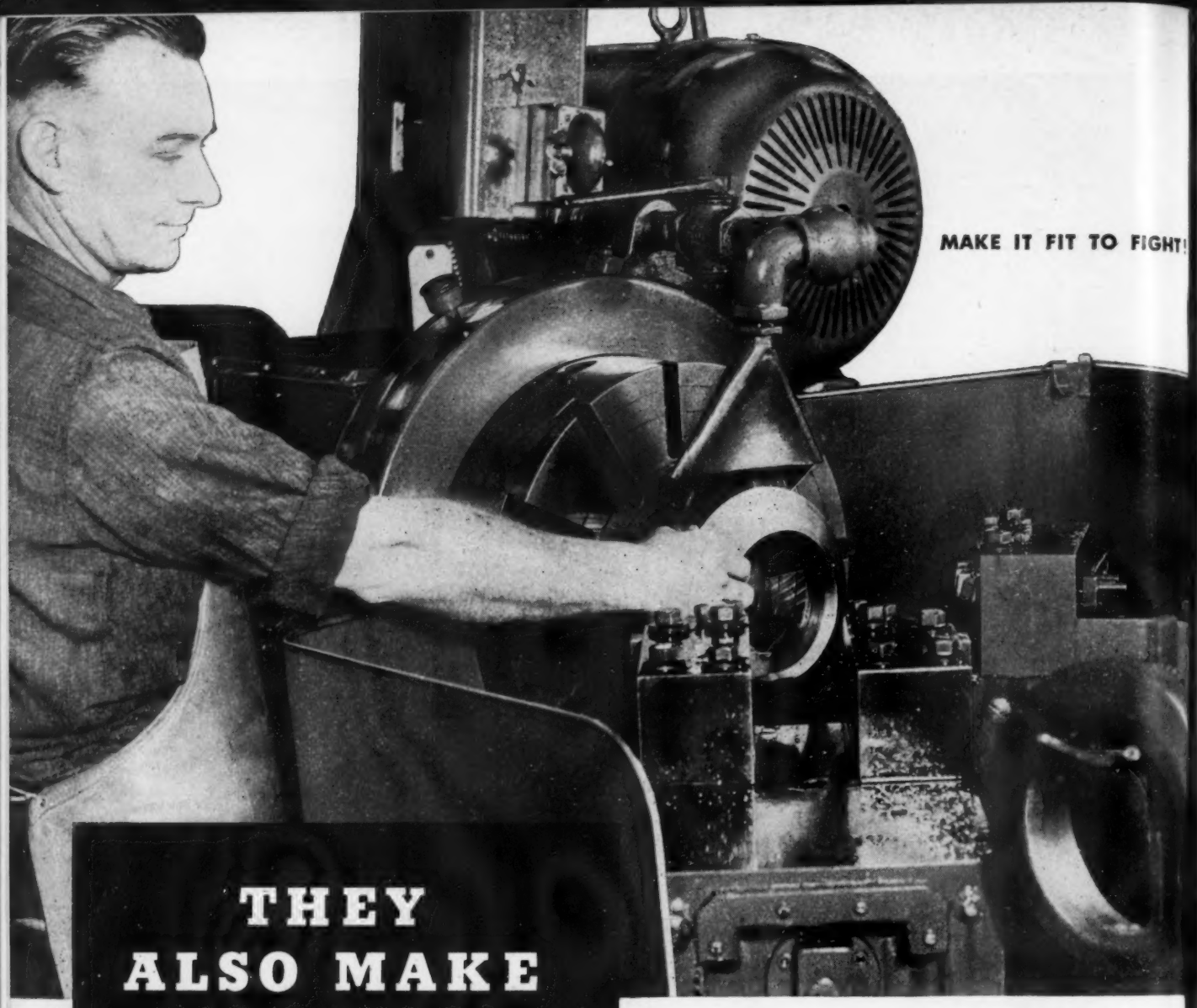
The MARVEL No. 8 is the most universal sawing machine built. It will snip off an ⅛" drill rod or cut off an 18" x 18" structural shape with equal efficiency, or will save hours of machining by roughing work to size and shape. It will cut at any angle from 45° right to 45° left, has a large "T"-slotted table (for holding irregular shapes, special fixtures, etc.) and both power and hand feeds. It is a busy machine wherever found, for it does so many different jobs and does each one well.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave., Chicago, U. S. A.

Eastern Sales Office: 225 Lafayette St., New York



MAKE IT FIT TO FIGHT!

THEY ALSO MAKE *Time*

GISHOLT

GISHOLT SIMPLIMATICS provide the extremely high speed essential in the mass production of parts for planes, tanks, trucks, jeeps and other vital war equipment.

With their automatic machining cycles, these multiple-cutting lathes require little more of the operator than to load and remove the work. The machine does the rest —swiftly, accurately.

Making a wide variety of parts is only half of a Simplimatic's job. Making them in less time is the other. For in war, time saved is time earned.

GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison, Wisconsin

Look Ahead... Keep Ahead... With Gisholt Improvements in Metal Turning

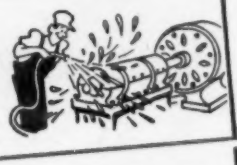
TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION

Have You a Tough Grease Problem?

HOW TO SOLVE Operating Problems with *Correct Lubrication*

JUST LOOK AT SOME OF THE OPERATING CONDITIONS SPECIAL GARGOYLE GREASES ARE LICKING. THE EXPERIENCE THAT DEVELOPED THESE GREASES IS AVAILABLE TO YOU...

HIGH TEMPERATURE	OVER 400° F.		Gargoyle Grease BRB4 Gargoyle Sovarex Grease
EXCESSIVE WATER	WATER-FLOODED BEARINGS		Gargoyle Grease AA Gargoyle Sovarex Grease
EXTREME SPEEDS	20,000 TO 50,000 R.P.M.		Gargoyle Grease BRB4 (for ball bearings)
HIGH PRESSURES	MEETS MOST SEVERE STEEL MILL USE		Gargoyle Grease Sovarex L
LOW TEMPERATURE	−40° F.		Gargoyle Mobilgrease Zero
WIDE TEMPERATURE RANGE	+250° F. TO −60° F.		[Name on Request]

IF YOU are responsible for the operation of any machines or equipment that are grease-lubricated—*be sure you've heard the Gargoyle Grease story!*

There is available to you the same full line...the same high quality in Gargoyle *Greases* that you have learned to depend upon in Gargoyle *Oils.*

And they are sold on the same basis i.e. *their use will bring you benefits in power and maintenance economies...and in full time, capacity production!*

SOCONY-VACUUM OIL CO., INC.—Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corporation of California

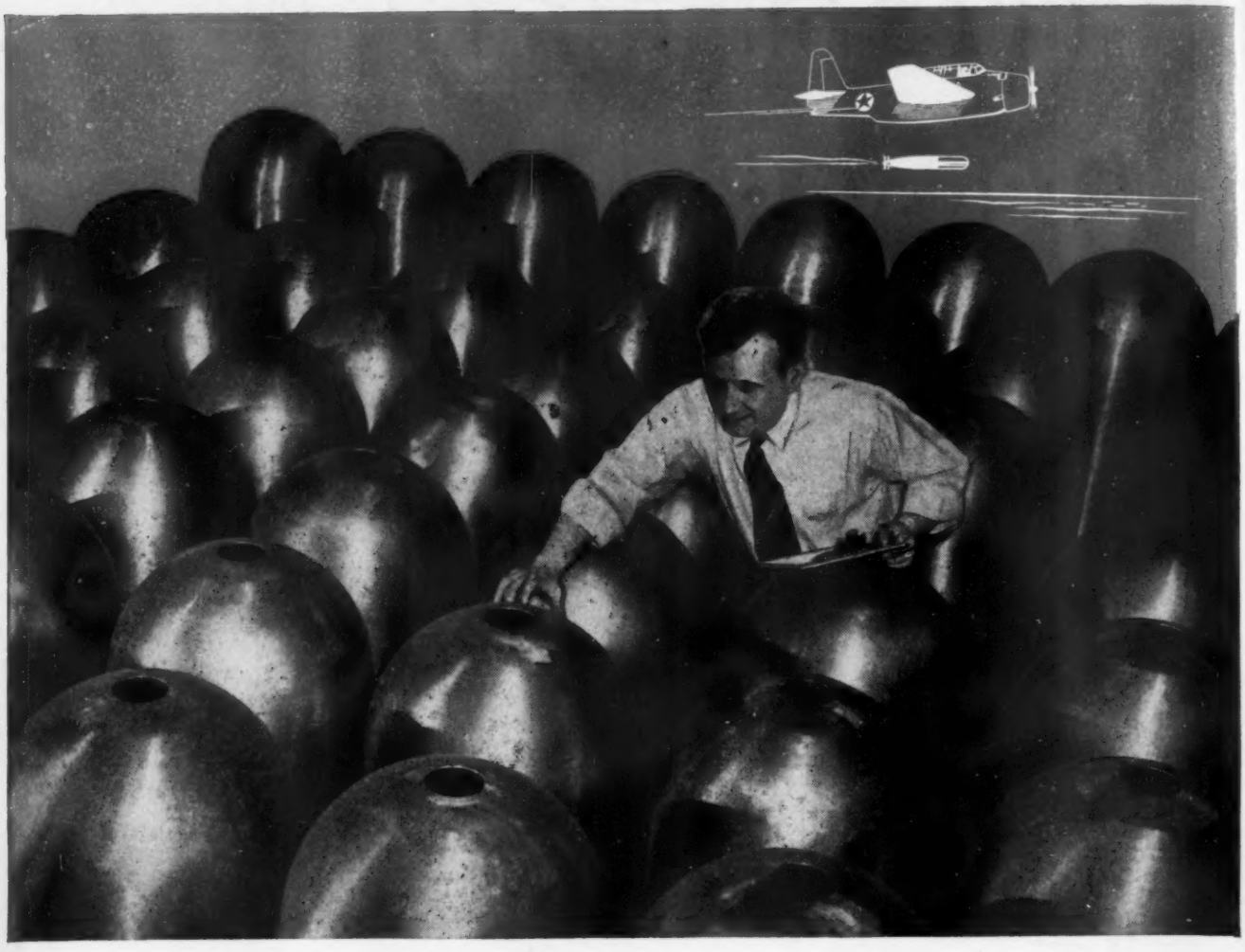
GARGOYLE

Lubricants

HEADQUARTERS FOR GREASES TO MEET EVERY PROBLEM—

SOCONY-VACUUM

ONE OF A SERIES OF SUGGESTIONS TO AID PRODUCTION



WAR HEADS for TIN FISH

READY to be loaded with explosives, these war heads of giant, one-ton aircraft torpedoes are getting a final inspection. Producing the surface finish shown in the photo, as well as the more than 5,000 component parts of a completed torpedo, requires top performance from machine tools and cutters.

In the precision machining not only of torpedo parts but of millions of bullets, shells, guns, tanks and planes, war plants everywhere are assured of faster output and increased cutting-tool life, by using *Texaco Cutting Oils.*

Texaco Sultex, Transultex and *Clear-tex Cutting Oils* lubricate the tools, carry away the heat and prevent chip welding, assuring improved surface finish, and maximum output per tool grind.

So effective have Texaco lubricants proved that they are definitely preferred in many important fields, a few of which are listed in the panel.

A Texaco Engineer specializing in cutting coolants will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

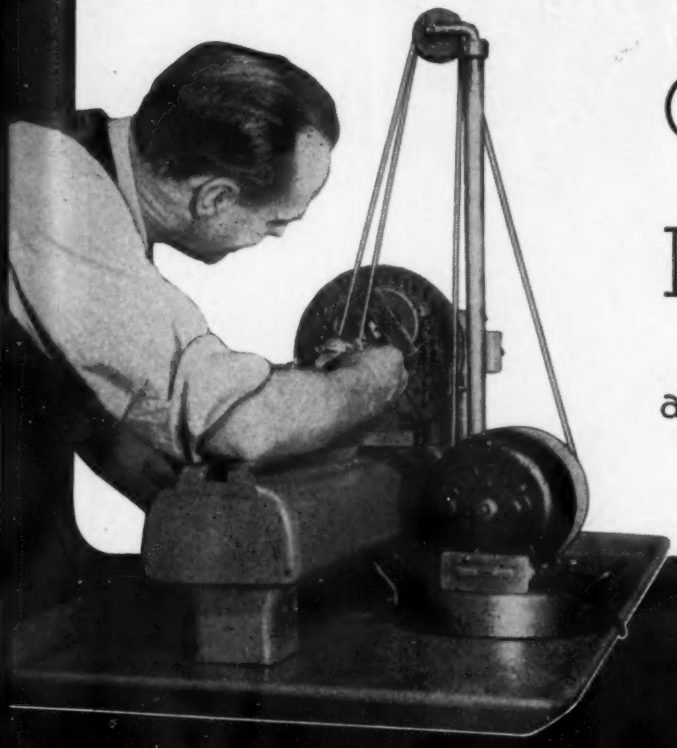
TEXACO

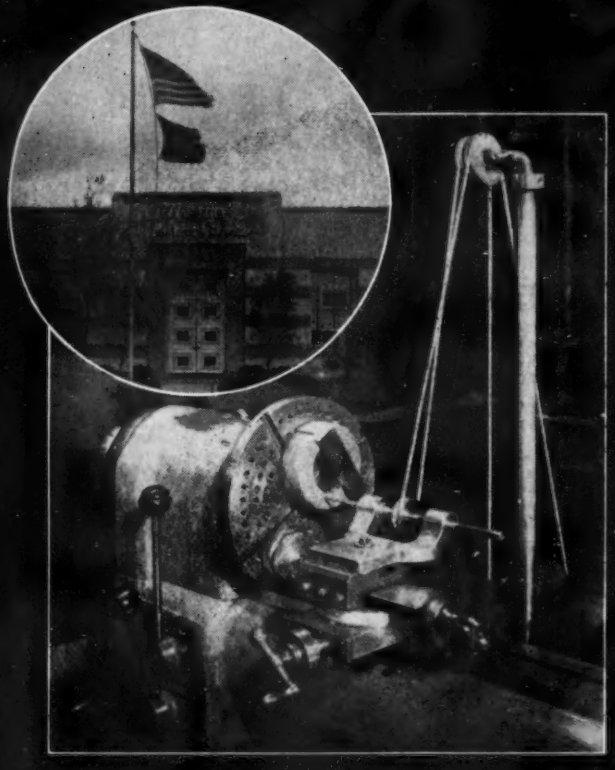
TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

HARDINGE Precision Lathe Grinding a Precision Gage

at Metro Tool and Gage Co.
Chicago, Illinois





The HARDINGE High Speed Precision Lathe is being installed in ever increasing numbers in tool and die shops in the United States and Canada because they are well suited to a wide variety of work involving the precision limits in modern manufacturing.

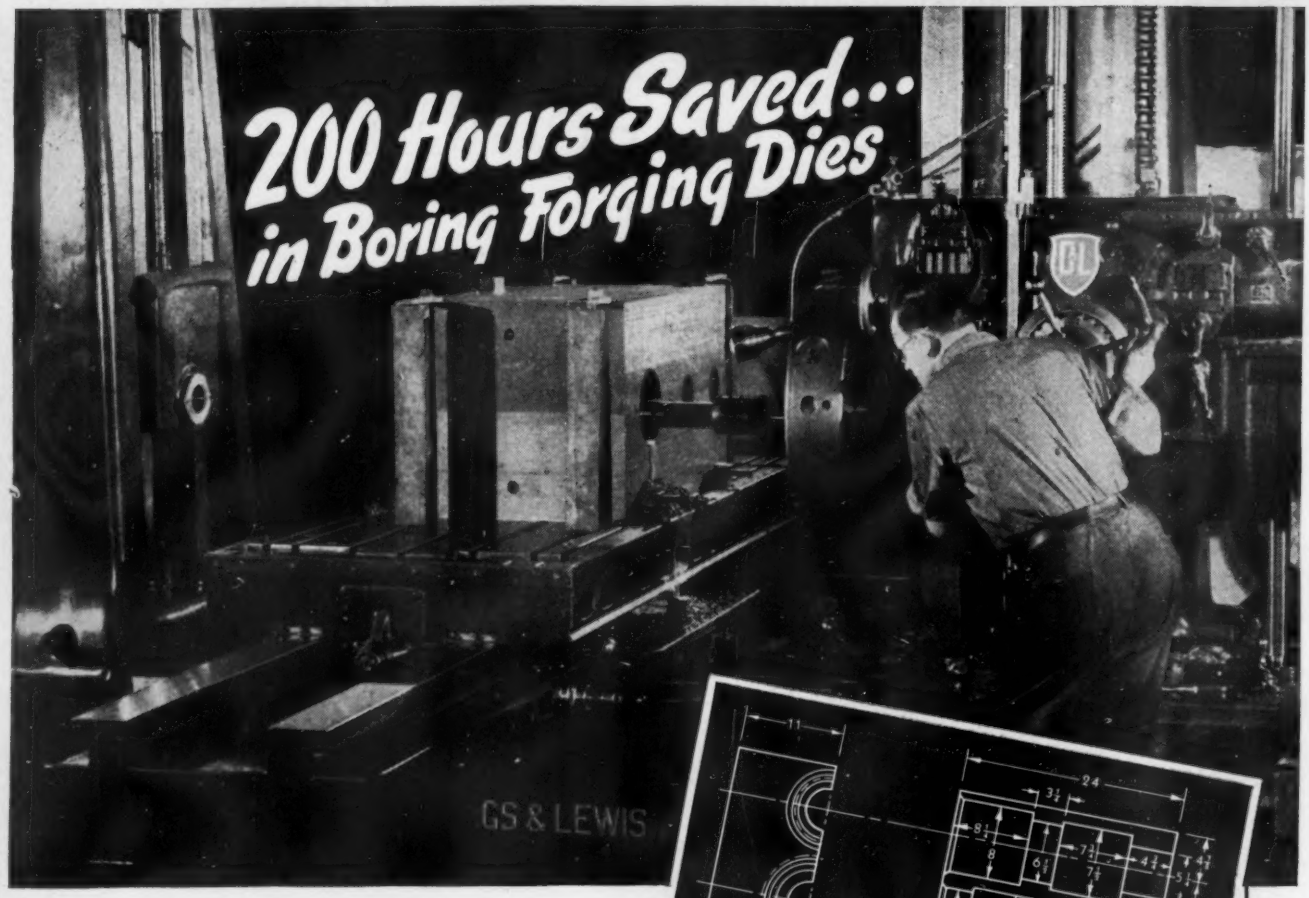
The sustained accuracy of the HARDINGE High Speed Precision Lathe means dependability in operation.

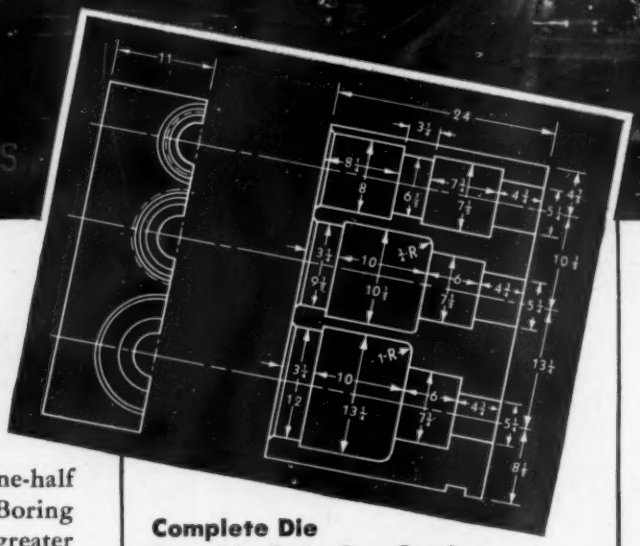
Write for 16 page bulletin describing this machine and other Hardinge Precision Products.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

HARDINGE
ELMIRA, N.Y.

200 Hours Saved... in Boring Forging Dies





Giddings & Lewis Horizontal with Continuous Feed Facing and Boring Head Cuts 300-Hour Job to 100 Hours . . .

This Forging Die was formerly machined by boring one-half at a time. With the G & L Continuous Feed Facing and Boring Head both parts are machined simultaneously with greater speed, accuracy and economy of cutting tools. Tool settings have been reduced to a minimum. Jump cutting with the old method placed a burden upon the tools. Proper mating diameters and finish are obtained because both parts are machined simultaneously in one setting.

On this and similar dies in this plant the machining time has been cut one-third with the G & L Horizontal equipped with the continuous feed facing and boring head.

Additional flexibility and capacity for handling unusual jobs can be added to your G & L Horizontal through the application of a G & L rotary table together with G & L Continuous Feed Facing and Boring Head. Boring, facing and back-facing can be performed on several surfaces by merely indexing the table and engaging the cross-slide of the head. Investigate the complete features and advantages on this equipment today. Write for the descriptive folder offered at the right.

Complete Die Bored in Only One Setting . . .

Prior to machining on the G & L Horizontal, both parts are opened up straight through on a planer to enable a boring bar to be inserted. The operations on the largest bore are performed as follows. The other two bores are machined in a similar manner.

Operations

1. Bore 5¼" Dia. for a Distance of 4¾" with Conventional Boring Bar.
2. Bore from front 7¾" Dia. Using Conventional Boring Bar.
3. Bore 12" Dia., 13¼" Deep Using Conventional Boring Bar.
4. Recess 13¼" Dia. Using the Continuous Feed Facing Head, Set Off Center.
5. Finish Bore 13¼" Dia. Using the Continuous Feed Facing Head.
6. Form Radius in Corner with Tool Ground to Proper Radius Using Continuous Feed Facing Head.

NOTE: Built in scales and verniers easily permit working to .001" on center distances between holes and the location of the bores accurately on the split of the die.

Additional Data

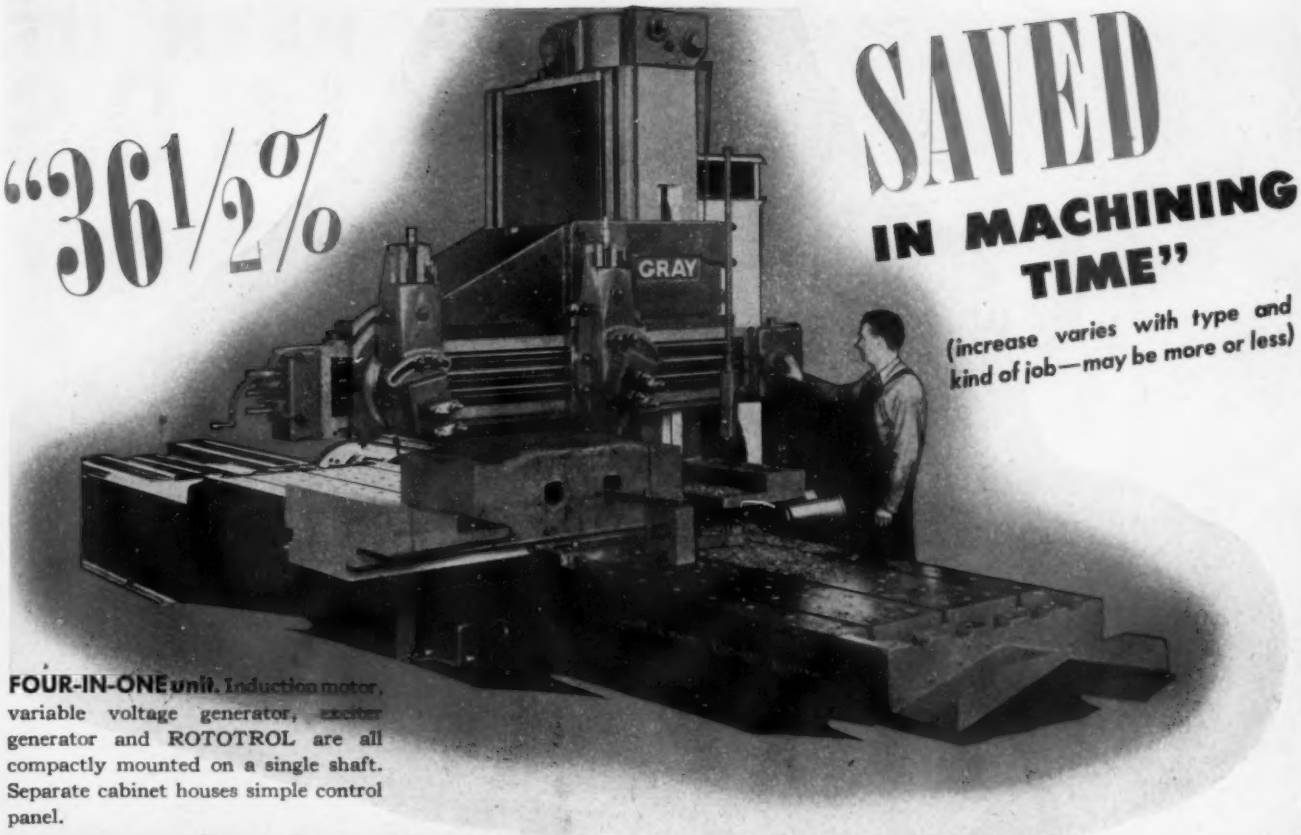
Additional data is contained in this folder. When making inquiry please indicate your business connection and type and size of machine used. Ask for Bulletin No. 82.

GIDDINGS & LEWIS MACHINE TOOL CO.

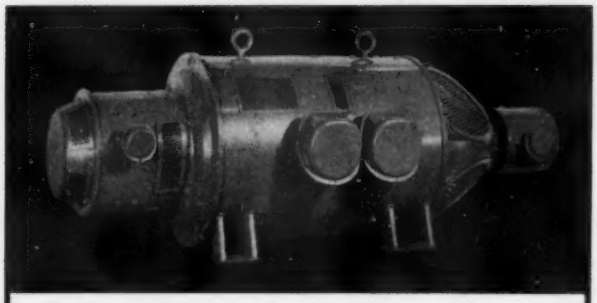
138 DOTY ST., FOND DU LAC, WISCONSIN

"36½% SAVED IN MACHINING TIME"

(increase varies with type and kind of job—may be more or less)



FOUR-IN-ONE unit. Induction motor, variable voltage generator, exciter generator and ROTOTROL are all compactly mounted on a single shaft. Separate cabinet houses simple control panel.



WHAT THE WESTINGHOUSE VARIABLE VOLTAGE PLANER DRIVE DOES

- Gives more *cutting strokes* per minute —gives faster acceleration and deceleration—*speeds reversing time.*
- *Reverses accurately to a line*—provides accurate control for planing up to shoulders or in blind pockets.
- *Provides constant speed* at any setting over entire range, regardless of voltage or load fluctuations.
- *Cuts machine outages* for control maintenance.

...using Rototrol and Westinghouse

VARIABLE VOLTAGE PLANER DRIVE

"36½% of the machining time formerly spent on this job has been saved by substituting Westinghouse Variable Voltage Drive for the conventional reversing motor."

This report from the owners of the above 48″ x 16′ Gray open-side planer is typical of the results obtained with this simpler, faster, more accurate control.

Thanks to Westinghouse ROTOTROL—the versatile control scheme that permits faster acceleration and deceleration—the Westinghouse Variable Voltage Drive can speed up the reversing action of the table, stop it at the precise same point every time, and give MORE cutting strokes per minute. Wider speed range (40 to 1200 planer motor rpm) permits use of the most efficient cutting and return speeds to fit the job.

Get the full details on this perfected and proved production booster! Ask your Westinghouse representative for B-3064. Westinghouse Electric & Manufacturing Co.

J-21202

Westinghouse VARIABLE VOLTAGE DRIVES

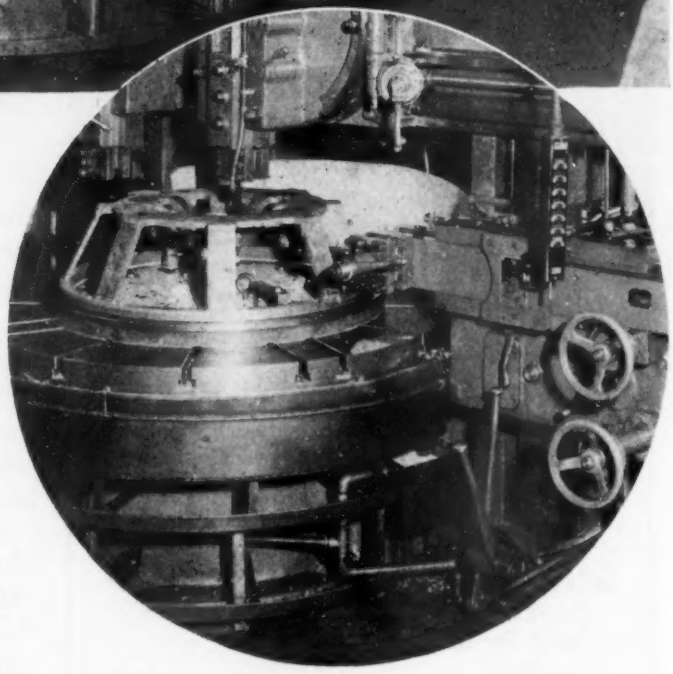
A PAIR OF KINGS

meet precision requirements

● Rigidity — Accuracy — Ease of operation are three points in the design and construction of King Vertical Boring and Turning Machines that have been proved over and over in the fine finish and high quality of the work produced.

Here in the plant of a firm of international reputation two King Vertical Boring Mills are meeting the requirements of both accuracy and productivity.

For precision — for ease of operation — for dependability make your next Vertical Boring Machine a KING.



● Cut line — Close up showing right hand swivel head turning inside diameter while right hand side-head turns outside diameter simultaneously.

The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

PHOTO COURTESY THE HOSDREG CO., INC., HUNTINGTON, INDIANA

SHE'S GINNY CLOSE—21 years old—95 pounds—married—member of the 10% Club—she's a WOW*. In fact she's the smallest multiple spindle automatic lathe operator in the world.

But she holds a more important record—2286 shells produced in 8 hours with the help of her 8-spindle Conomatic. She does her own tool setting, loads the machine with stock, beats the boys at their own game, then takes care of her six room house, and feeds 100 chickens and a farmer husband.

The Hosdreg Company is pretty proud of Ginny, with her cheerful attitude and happy smile—and also proud of their Conomatics, with their easy operating features and outstanding production capabilities. Get a WOW like Ginny and a Conomatic on the job, and you're bound to break more than one record!

* Woman Ordnance Worker

CONE Automatic Machine Company, Inc., Windsor, Vermont

MOSQUITO BOMBERS

OF THE PRODUCTION LINE

VERNON Vertical Mills and Jig Borers are lightning fast in operation—as deadly as the Fortress, and built to do a superb job at substantially great savings in original cost. Truly —the mosquito bomber of the production line!

FEATURES... 8 spindle speeds, 4 belt changes · ultra precision, preloaded spindle ball bearings · spindle nose carburized, hardened and ground · spindle and internal taper ground for perfect concentricity · split thousandth table movements with measuring rods and dial indicators (if desired) · micrometer depth stop on quill · two quill feeds · headstock bore and quill honed for perfect fit · tapered gibs throughout.

Write for our bulletin —more features, full description, no cost.

VERNON VERTICAL MILL AND JIG BORER

NEW! Cal-Cutters—many types for all milling requirements. Write for catalog A-1.

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON LOS ANGELES CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

8" 6-spindle Type "D" Mult-Au-Matic machining spider. Close-up of stations, 4, 5, and 6.

Close-up of 16" 6-spindle Type "D" Mult-Au-Matic machining cylinder head.

Bullard 8" 6-spindle Type "D" Mult-Au-Matic machining transmission case.

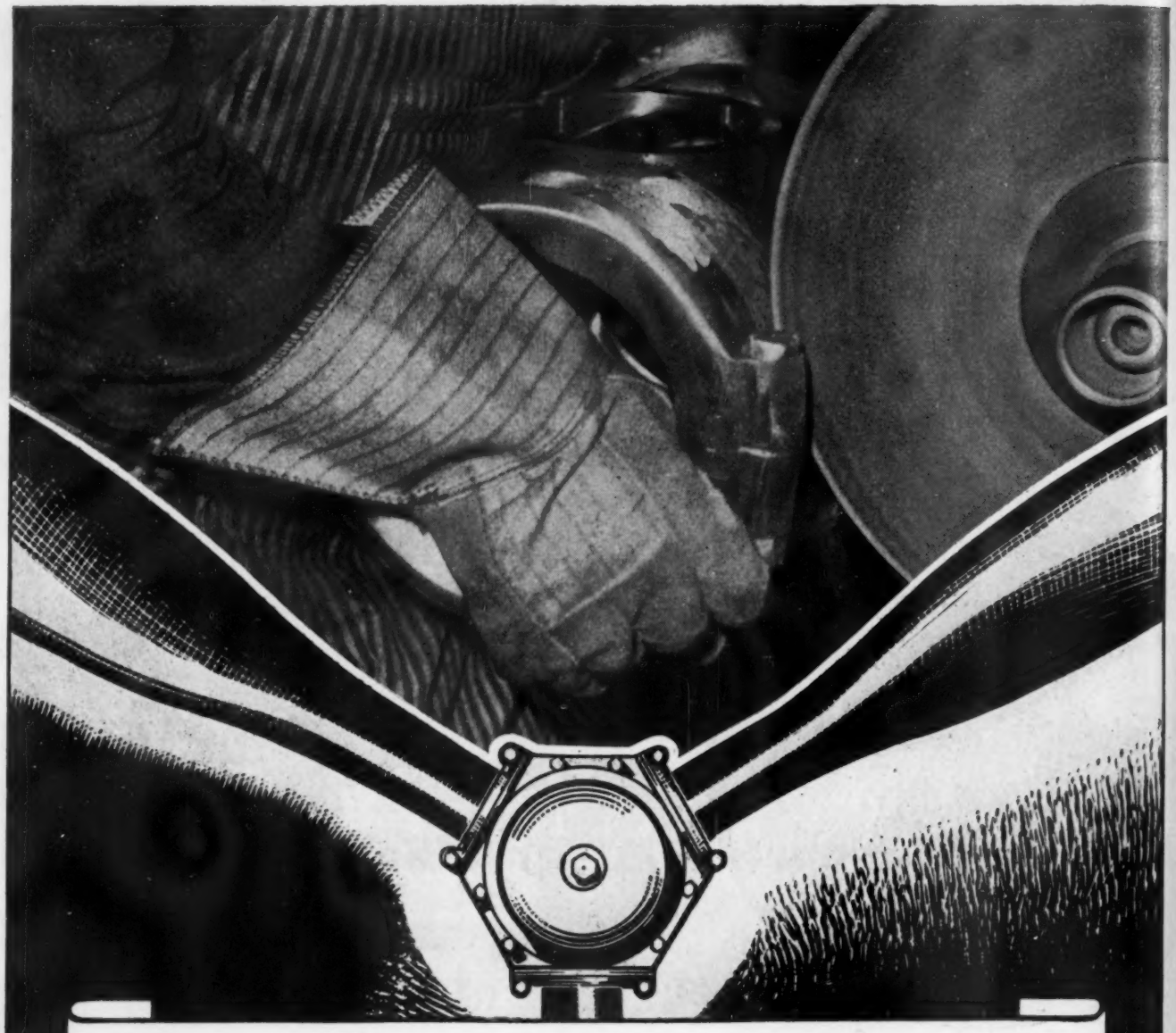
...ANY CHUCKING JOB WITHIN CAPACITY

These photographs very largely tell their own story. Each shows one of the war-time tasks on which the Mult-Au-Matic is saving precious minutes . . . making the most of manpower, floor space, and versatility in the machine.

One important fact the pictures tell is the quick adaptability of the Mult-Au-Matic. The amazing time reductions Bullard machines accomplish under stress of war are quickly available to owners of Mult-Au-Matics when the war is won.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT



Quality Polishing at Aircraft Speeds

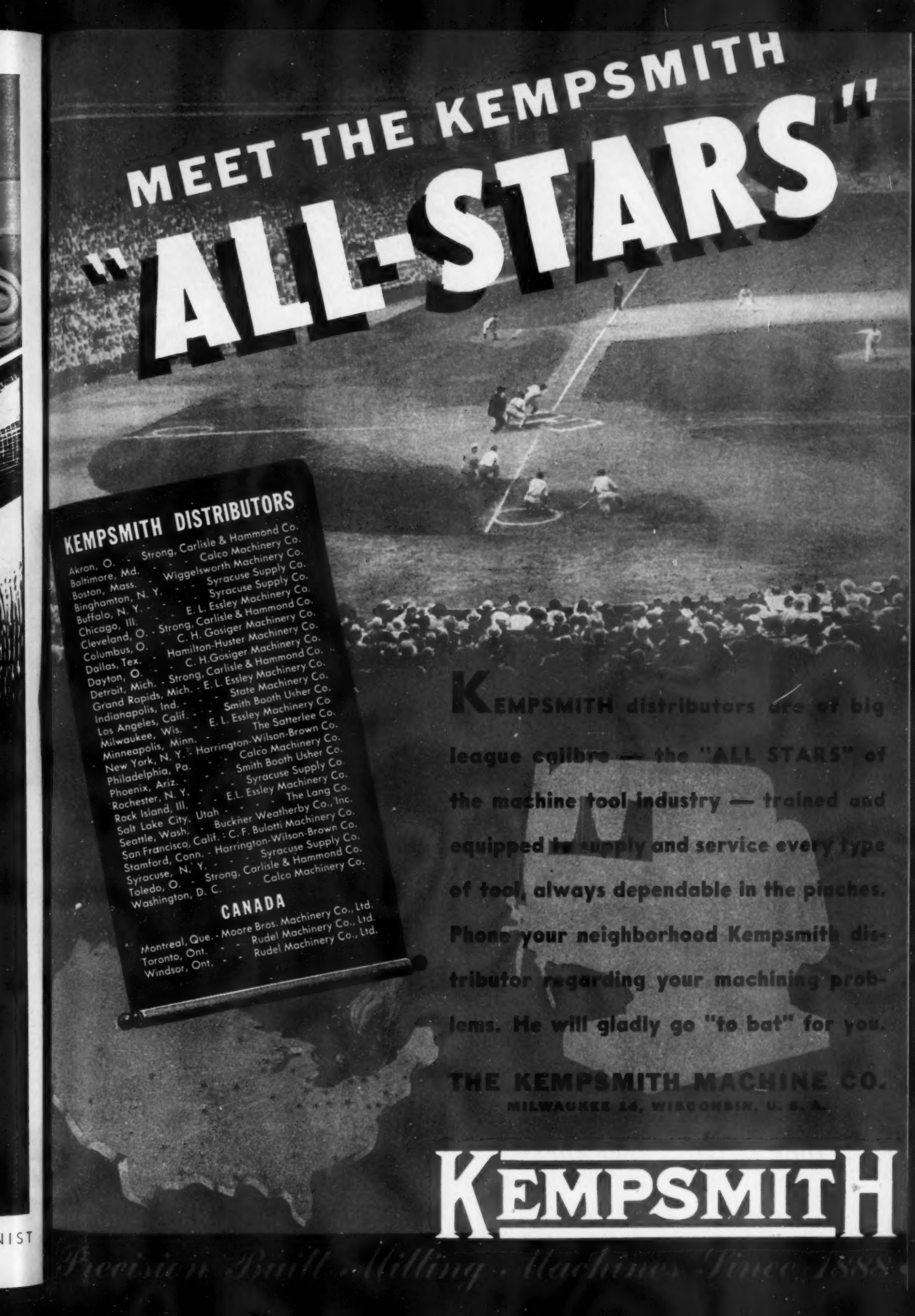
Calls for ALUNDUM ABRASIVE

SPEED is the watchword in everything connected with aircraft production today. That's why Hamilton Standard Propellers at East Hartford uses Alundum Abrasive for polishing this barrel and many other parts.

Special Norton crushing and screening processes control the grain size and shape of Alundum Abrasive, giving sharp, strong grains that cut fast. Special surface treatments give the grains extra capillarity—the ability to stay in the wheel head until all their work is done.

NORTON COMPANY, WORCESTER 6, MASS.

NORTON ABRASIVES


MEET THE KEMPSMITH
"ALL-STARS"
KEMPSMITH DISTRIBUTORS
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Baltimore, Md. - - - Calco Machinery Co.
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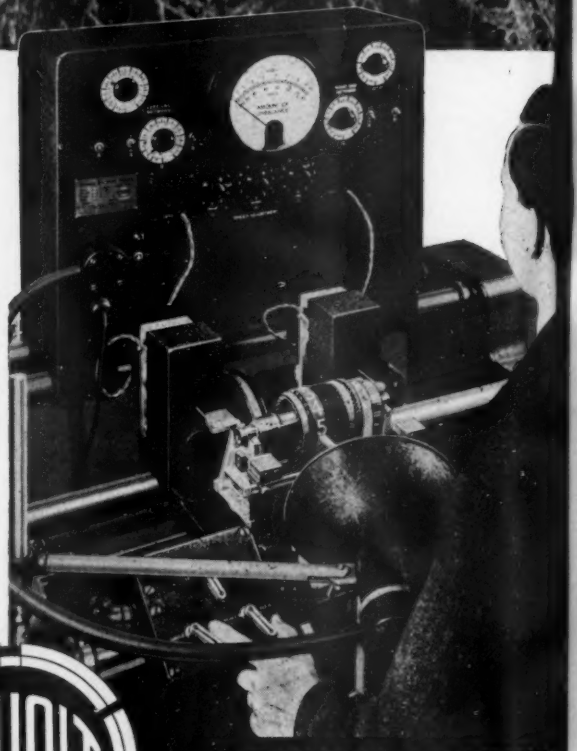
KEMPSMITH distributors are of big league calibre — the "ALL STARS" of the machine tool industry — trained and equipped to supply and service every type of tool, always dependable in the pinches. Phone your neighborhood Kempsmith distributor regarding your machining problems. He will gladly go "to bat" for you.
THE KEMPSMITH MACHINE CO.
MILWAUKEE 14, WISCONSIN, U. S. A.
KEMPSMITH
Precision Built Milling Machines Since 1888

"Needles in Haystacks" ARE EASY TO FIND



WHEN you put electrons to work, many "impossible" tasks become extremely simple.

So it is in Dynetric Balancing where the stroboglow lamp and electron tubes work together to *locate* and *measure* unbalanced forces in high speed rotating parts. Dynetric Balancing Machines now do in a few seconds what used to take minutes and hours. And they do it with a degree of fineness that is not possible by any other method.

Their greater speed and accuracy mean lower cost in assuring smoother performance and longer life in all kinds of modern precision machinery.

GISHOLT MACHINE COMPANY
1201 East Washington Avenue • Madison, Wisconsin

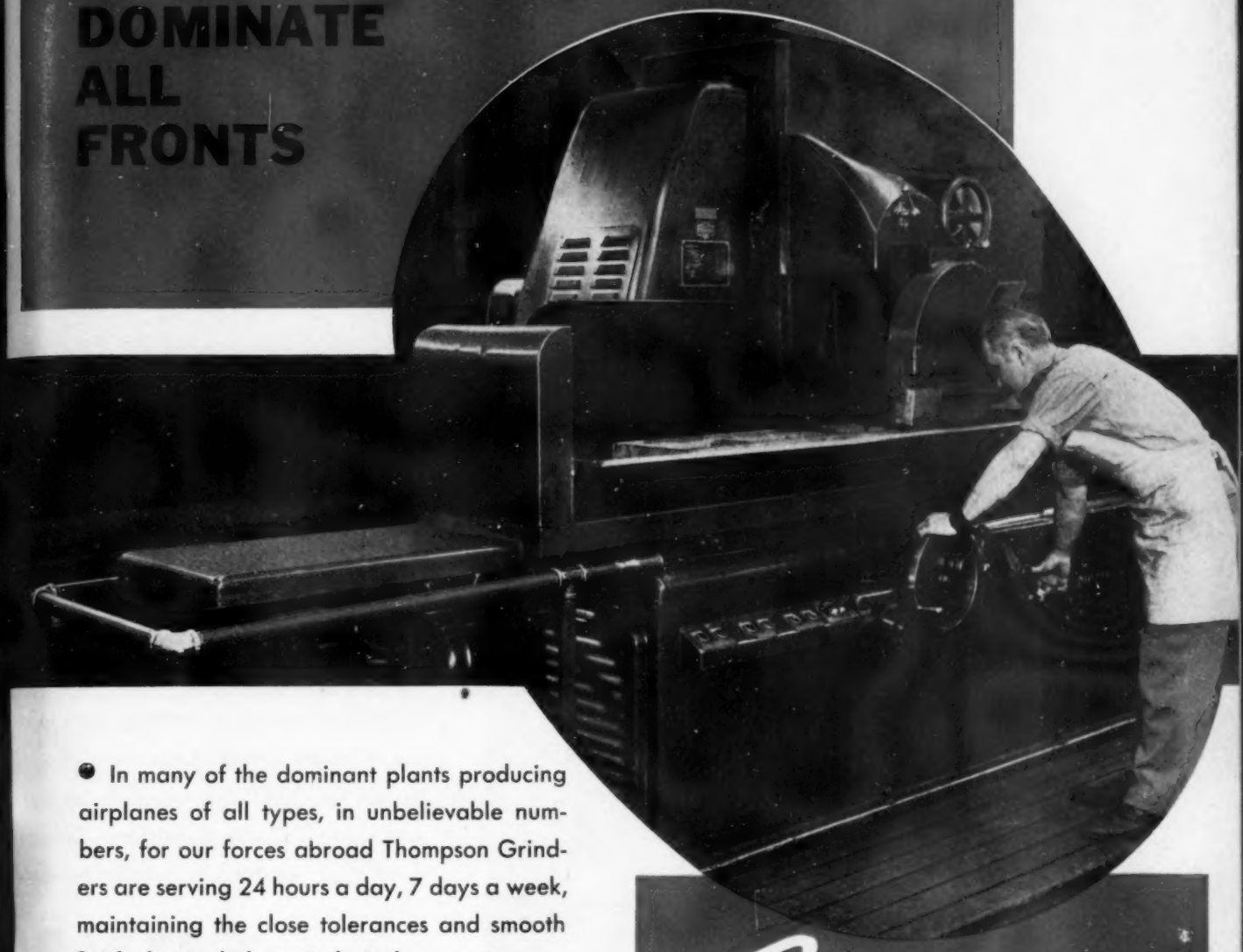
TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

GISHOLT

LOOK AHEAD . . . KEEP AHEAD . . .
WITH GISHOLT IMPROVEMENTS

DYNETRIC BALANCING MACHINES are extremely simple to operate. Their range of application has now been extended to cover the balancing of any part from 1 ounce to 50 tons. Literature on request.

TO HELP AMERICAN PLANES DOMINATE ALL FRONTS



● In many of the dominant plants producing airplanes of all types, in unbelievable numbers, for our forces abroad Thompson Grinders are serving 24 hours a day, 7 days a week, maintaining the close tolerances and smooth finish demanded on vital airplane parts.

The Type C Thompson Grinder shown is typical of the Thompson units now in the production lines of airplane companies.

The full hydraulic operation of both table and wheel head—the convenient, centralized position of all controls insure maximum production, quick acting, vibrationless operation and a dependable, smooth finish to all work.

For sustained accuracy and smooth finish over long periods make your next grinder a Thompson.

Thompson Grinders

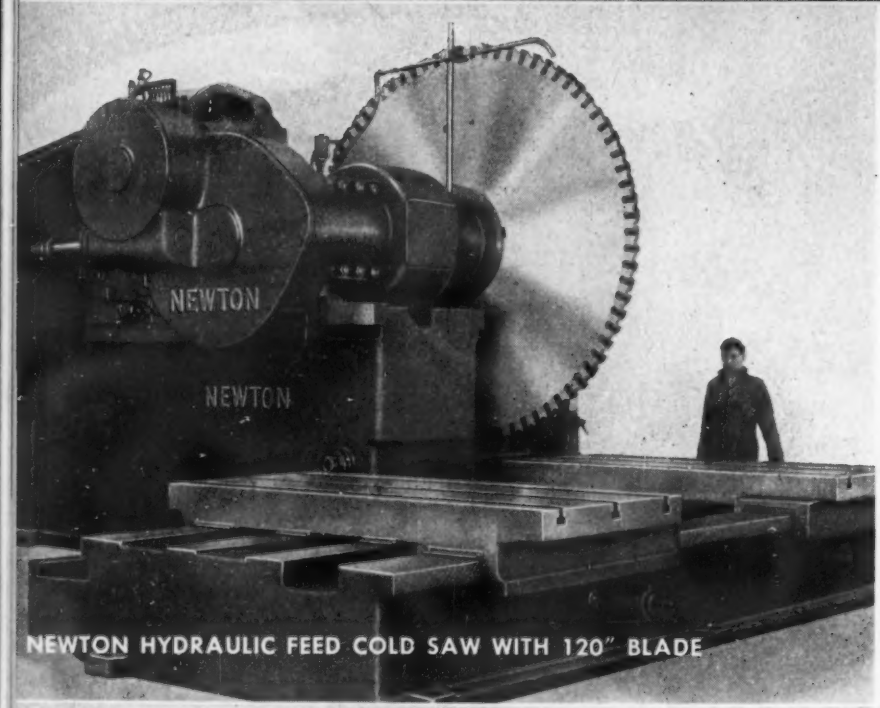
Thompson Grinders are built in a full range of types and sizes. The largest type C is 36" x 36" x 240".

THE Thompson GRINDER CO.

SPRINGFIELD, OHIO

BETTS 20' BORING MILL

BETTS-BRIDGEFORD
60" LATHES



NEWTON HYDRAULIC FEED COLD SAW WITH 120" BLADE

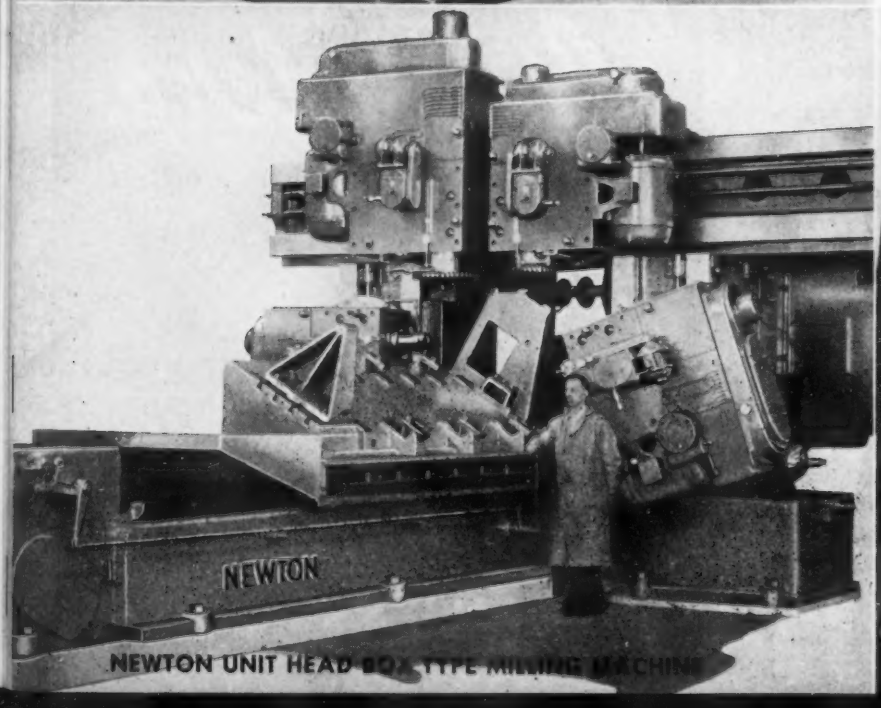
BIG MACHINE O

Whenever there are really big jobs to be don oats f
Consolidated machine tools can be depende me a
upon to do them. Shipyards, arsenals, tank fa ing v
tories and industrial plants are using Conso er-inc
dated machines to do the heavy work so esse ese t
tial to the production of war material. any a

So well has Consolidated done its job that t ecializ
Army-Navy "E" with three stars—denoting oblem
month's of outstanding production—proud solut

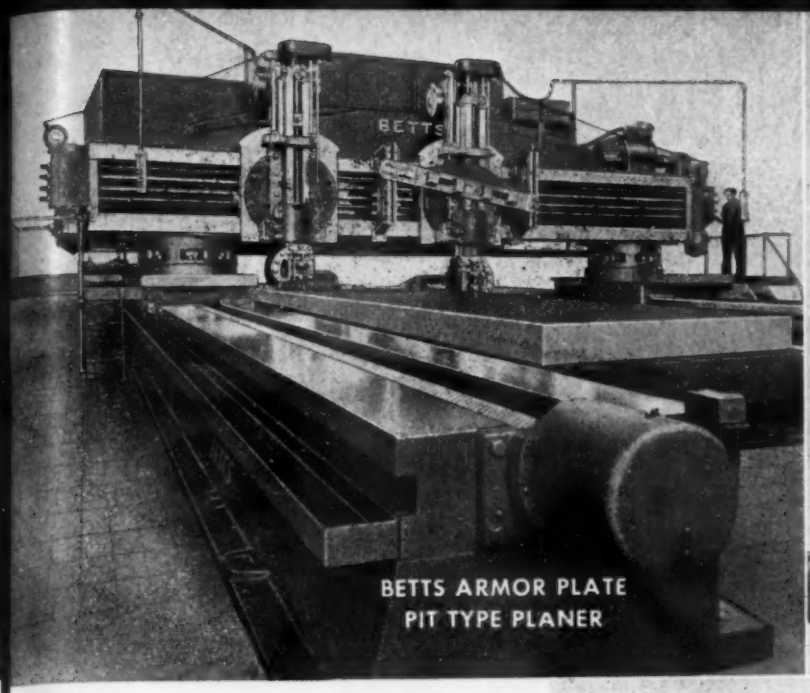
CONSOLI

MACHINE TOOL CORP
ROCHESTER 10 NEW

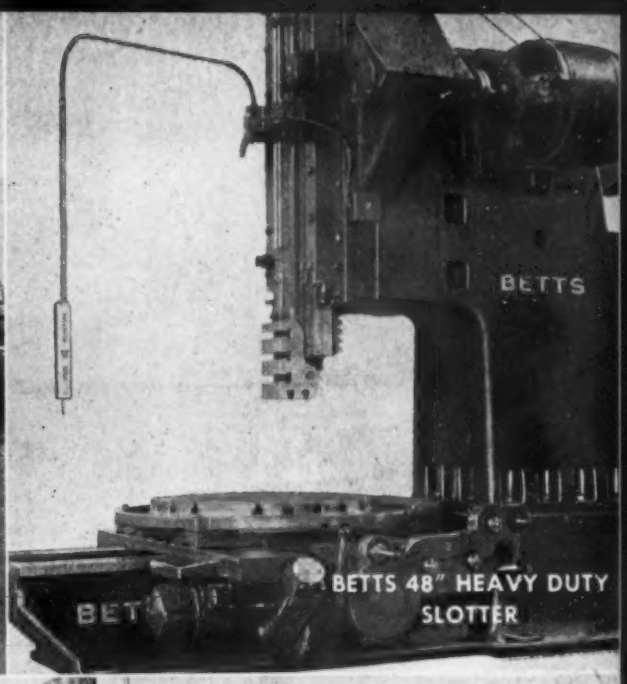


NEWTON UNIT HEAD BOX TYPE MILLING MACHINE

COLBURN ARMOR BOLT DRILL



BETTS ARMOR PLATE
PIT TYPE PLANER



BETTS 48" HEAVY DUTY
SLOTTER

NE OR BIG JOBS!

be don oats from the Consolidated flagstaff.

depende ome of the big Consolidated machines now

tank fo oing valiant service in America's battle for

Conso er-increasing production are illustrated on

so esse se two pages. Consolidated has helped

any a plant lick a production problem with

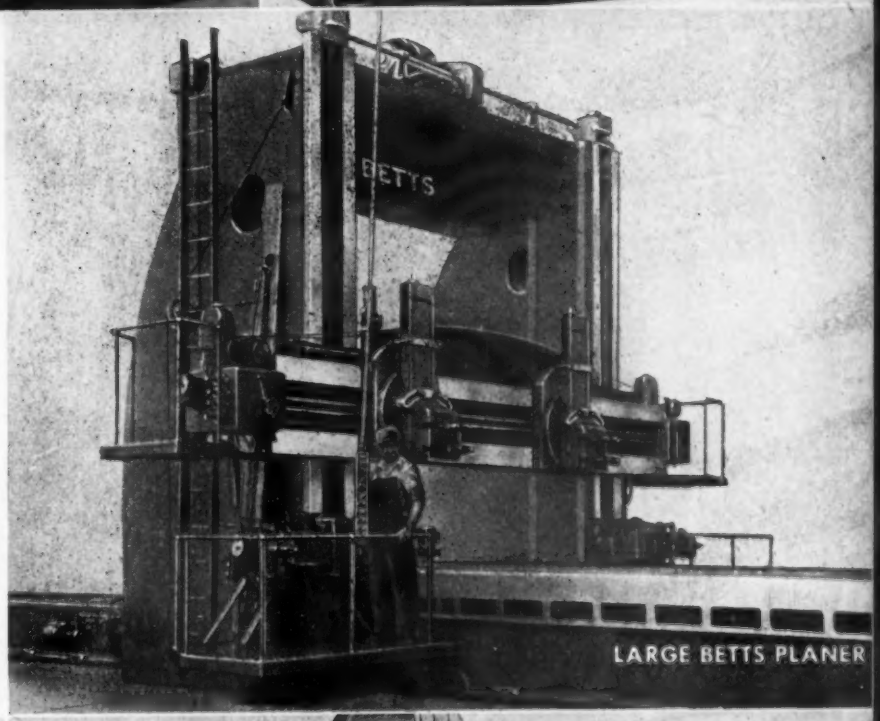
that t ecialized machine tools. If you have such a

noting oblem, we will be glad to work with you on

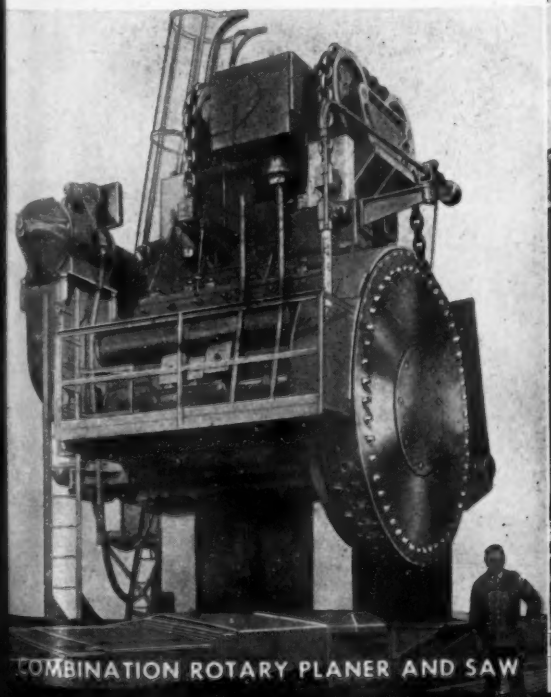
—prou s solution.

SOLIDATED

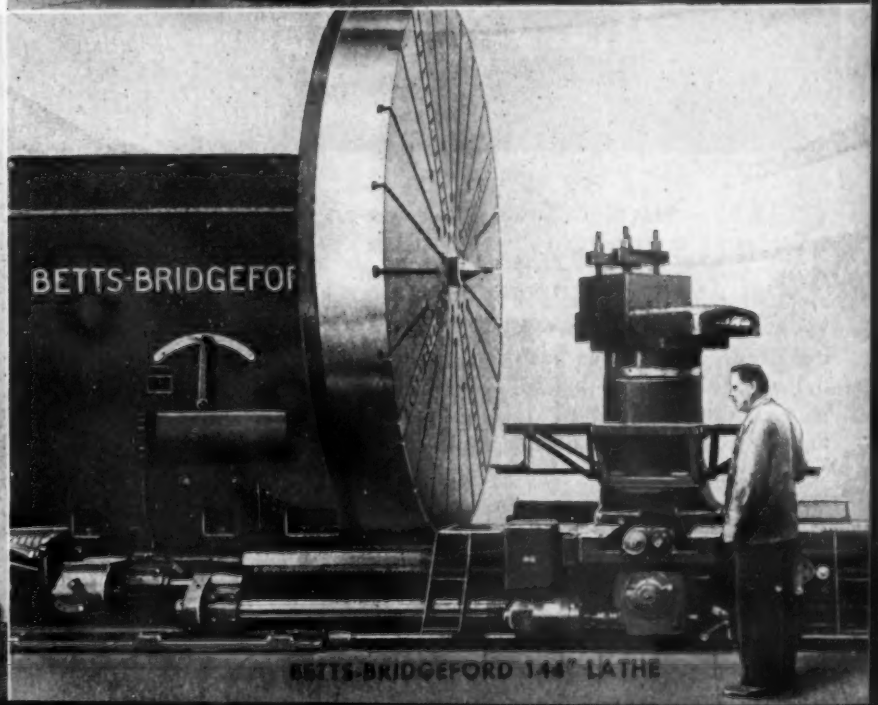
E TOOL CORPORATION
TER 10 NEW YORK



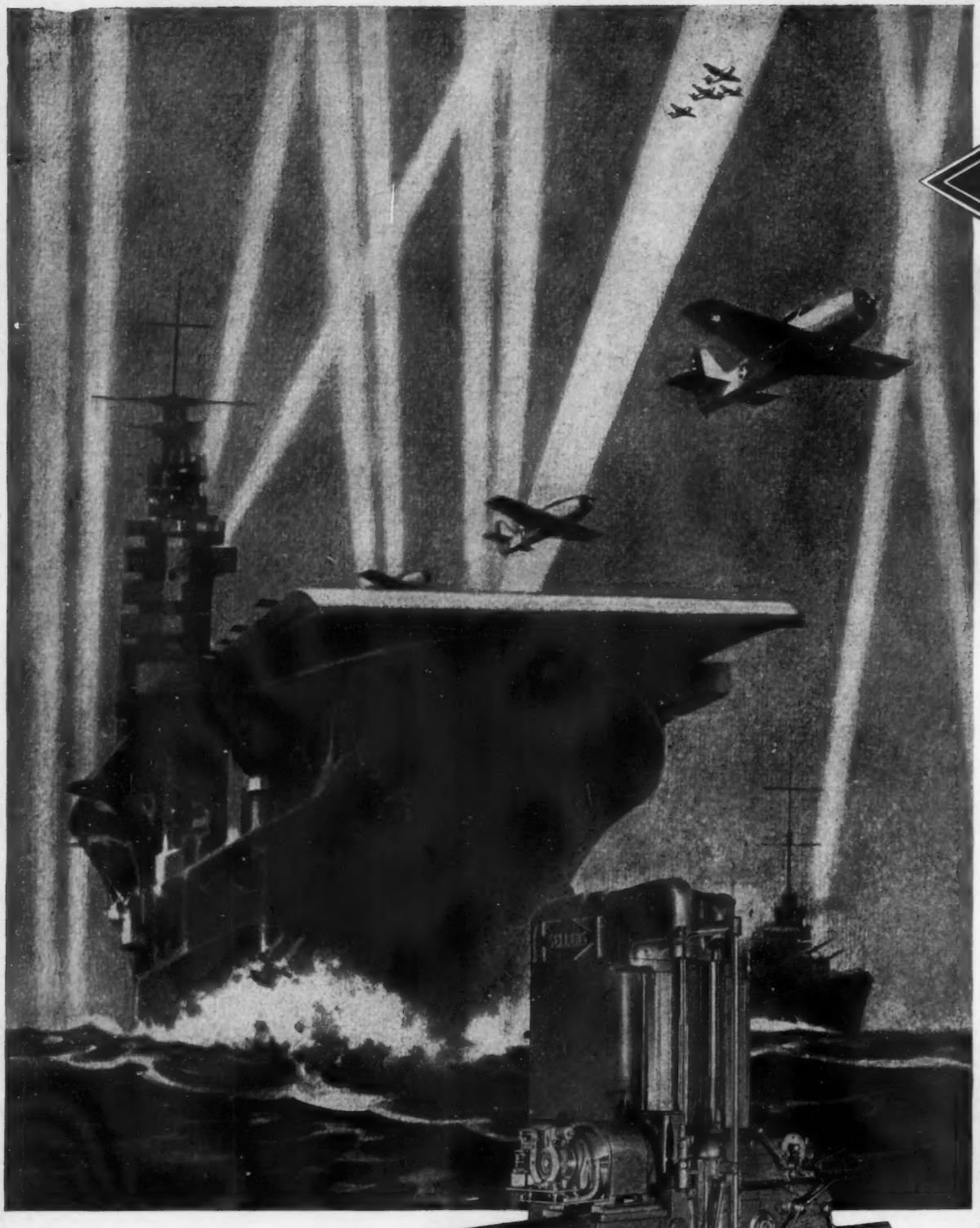
LARGE BETTS PLANER



COMBINATION ROTARY PLANER AND SAW

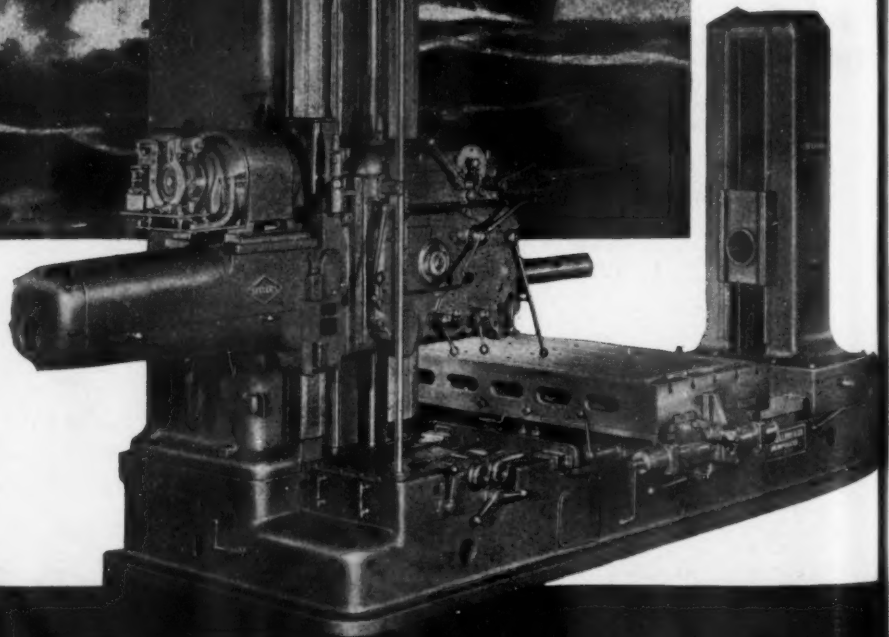


BETTS-BRIDGEFORD 144" LATHE



FOUNDED SELLERS 1848

Below is shown a 5" Table type Sellers Horizontal Boring, Drilling and Milling Machine.

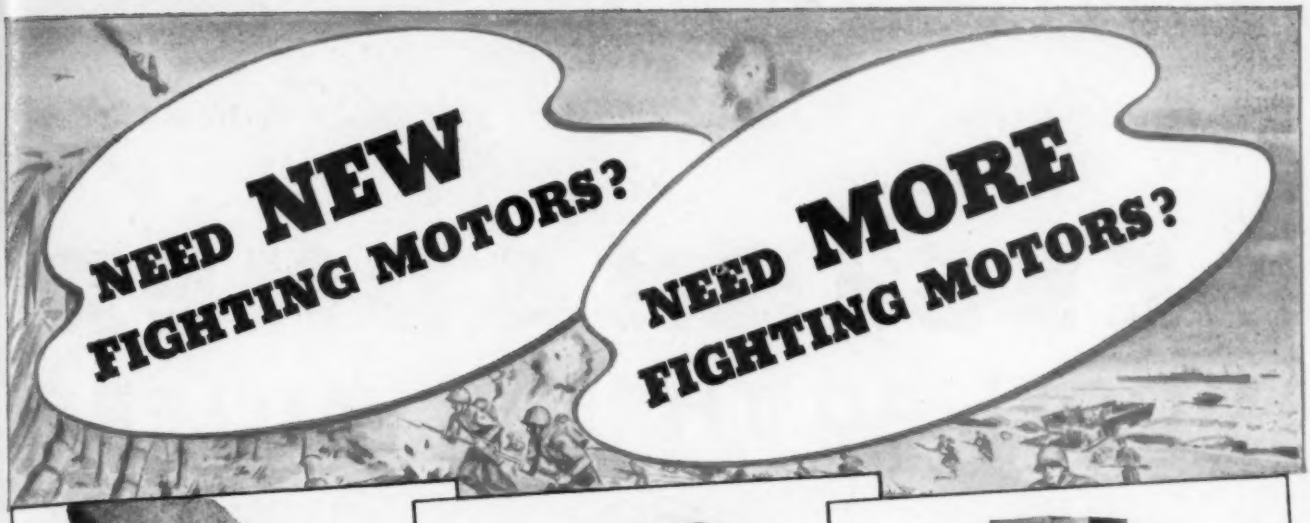


SELLERS Machine Tools are again playing their part in this, the fourth major war involving the United States since the Sellers firm was founded in 1848. No former war depended on machinery as much as has this one: that Sellers tools are needed so urgently and in such quantities is an obligation that Sellers workers have accepted as a duty.

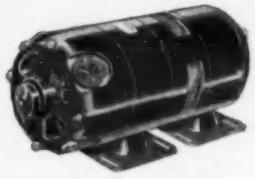
Sellers

WILLIAM SELLERS & CO., Inc.

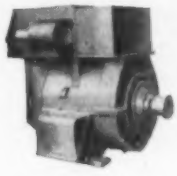
Philadelphia Penna., U.S.A.



1. TINY BUT VITAL, this G-E gear-motor for aircraft service weighs only 8 ounces. It provides driving force for protective devices and small controls. Rating: 3 watts, intermittent, at approximately 100 rpm.



2. DEADLINESS of our land, sea, and air weapons has been increased—by application of the G-E amplidyne. Along the industrial front this versatile new generator-type amplifier is speeding production.



3. EFFICIENT COOLING of this totally enclosed d-c motor is accomplished by an air-to-air surface cooler built on the machine. High output from small frame size is the result.

THIS G-E SERVICE IS MOBILIZED TO HELP YOU

IF THE war machines you build must be equipped with electric motors or generators, G.E. may be able to help you boost your output or motorize your designs in a better way. The important point is to get in touch with us *right at the start* of your planning.

Already, by close teamwork with builders of combat equipment, we have helped to engineer and build scores of ingenious fighting motors—many too secret to show here. Thus, a great fund of G-E experience is "on tap."

Facilities for further work on fighting motors are now available—not for every type, but possibly for the kind of motor that's right for your job. In any event, we'll give your problem prompt, realistic consideration, telling you frankly just how far and how fast we can serve you.

G-E engineers are helping apply all kinds of fighting motors to all kinds of war equipment. Your local G-E representative will help you take advantage of this service. *General Electric Company, Schenectady, New York.*

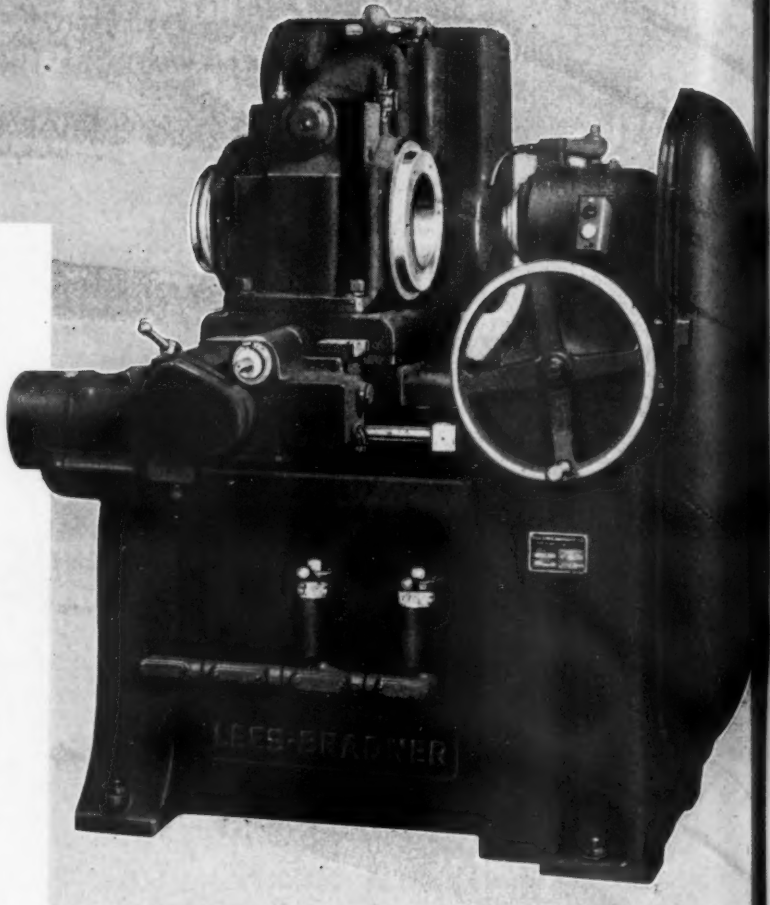
GENERAL ELECTRIC

750-215-8030

FIGHTING MOTORS

Simplicity and Ruggedness,
the Key to Accurate - High Production
on

LEES-BRADNER
MODEL 40 THREAD MILLERS



The Model 40 Thread Miller is a compact, high production machine designed and built for the generation of precision threads in quantity.

Simplicity of design—of construction—and of control account in a large measure for its high productivity without the need of skilled help. For the mass production of precision threads put your work on an L B Model 40 Thread Miller. Our Engineers available for consultation.

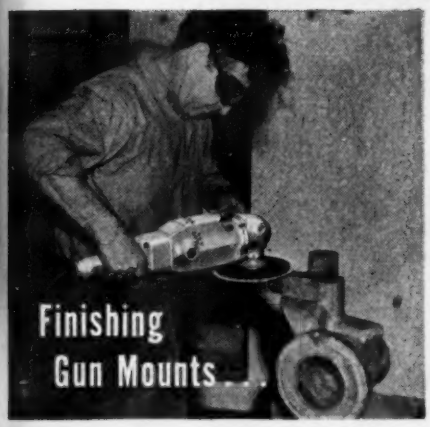
LEES-BRADNER

The **LEES-BRADNER** *Company*

CLEVELAND. OHIO. U.S.A.

"..Black & Decker Tools help speed Vital War Production & maintain shop equipment,"

SAYS PLANT SUPERINTENDENT



"We've used Black & Decker Tools almost exclusively during the plant's lifetime. They are sturdy tools, take a terrible beating...but never break down."

THIS comment, from the superintendent of an eastern machine shop's assembly and fabricating department, reflects typical reports from men who know and use Black & Decker Portable Electric Tools. This particular plant is presently engaged in vital war production . . . uses Black & Decker Heavy Duty Sanders in the finishing of parts and assemblies for the naval program . . . keeps other production equipment in top running condition with the help of B & D Drills and Bench Grinders.

Throughout war industry, husky Black & Decker Tools are helping speed vital production jobs such as these . . . helping maintain other production equipment equally as vital. And, sometimes when production "bottlenecks" or unavailable equipment have threatened to choke off the weapons America needs, ingenious war producers have combined experience and brains with these tools to perform new, unprecedented war jobs . . . "to turn out the goods faster and better."

Our New, Illustrated Booklet, *"They Used Their Heads," describes instances of America's system of free enterprise at work . . . of close cooperation between production experts and the men who supply them. Write for your copy. The Black & Decker Mfg. Co., 716 Pennsylvania Ave., Towson-4, Md.*

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

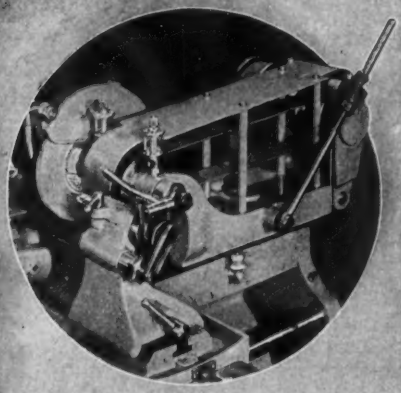
RIVETT

104 INT.-EXT. GRINDER

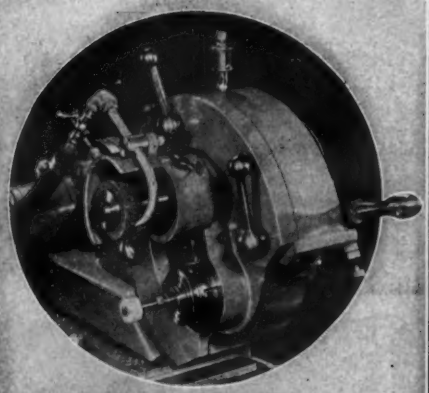
For Small Hole, Cylindrical and Concentric Grinding

The Rivett No. 104 is a simple, accurate grinder suitable for die and tool making as well as precision manufacturing. Its ease of set-up and operation and its selective spindles make it an efficient machine for internal and external grinding. The internal or external grinding spindle head may be selectively mounted on cross slide as desired. [illegible] work requiring concentric grinding of internal and external [illegible] at one chucking, turret carrying both internal and [illegible] may be used.

Work may be held in collet, step chuck, jaw chuck or fixture or on centers when using external [illegible] table reciprocation has three speeds from 54 to 126 passes per minute. Length of table travel is infinitely adjustable between ¼" and 2" or ½" and 4" depending on range selected.



External Spindle and Tailstock

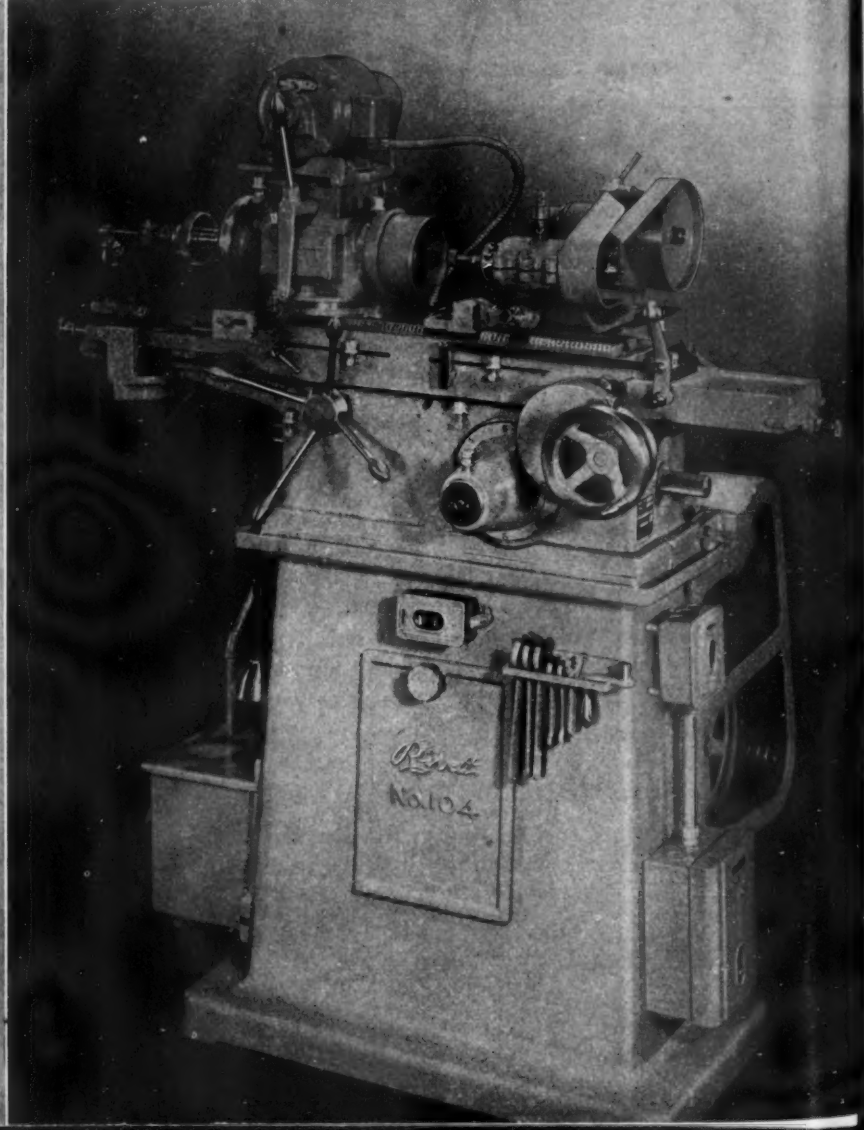


Internal and External Spindles in Turret

SPECIFICATIONS

Grinding cap., hole dia.	up to 3"
Grinding cap., outside dia.	up to 3"
Automatic table travel	
Standard	¼" to 2"
Special	½" to 4"
Hand table travel	11"
Swing over table	8"
Center distance	8"
Workhead swivel	90°
Table swivel	5°
Cross feed graduations	
Standard	.0005"
Special	.0001"
Travel of cross slide	1¾"
Collet capacity	⅞"
Step chuck capacity	6"
Jaw chuck capacity	6"
Workhead spindle speeds	200, 375, 600 r.p.m.
Grinding spindle speeds:	
Standard int.	21000 and 25000 r.p.m.
External	3800 r.p.m.
Net weight with motors	1750 lbs.

For Further Description Write for Bulletin 104



ARMY-NAVY E

RIVETT LATHE & GRINDER INC.

The KELLER that cut capers

A Short Story from P&W's Files

TIRED from a twelve-hour tussle with a tough problem in one of our customer's plants, a Pratt & Whitney field service man arrived at his hotel and found another call for help from a plant 300 miles away. Keller Machine trouble . . . something wacky with the controls. Our man wearily boarded a train and reported the next morning.

Yes, there it was, the Keller that cut capers. It had been running perfectly for a year in the hands of one operator, but since a second shift was put on, there had been difficulties. Our man opened the control box, found two relays out of adjustment, and fixed them. But just on a hunch, he waited around until the second-shift man arrived in mid-afternoon.

The Keller, you know, is an interesting machine. You make up exactly the shape you want out of plaster or wood or whatever is easiest. A tracer on the machine "feels" out this master shape, and controls a cutter down below working in tough die steel. It carves out complex two or three dimensional shapes with ease . . . to very close tolerances. Controlling the operation is a set of electrical relays . . . a fascinating study for anybody with an inquisitive nature.

The second-shift operator turned out to be just that kind . . . a bright young man, earnestly trying to get ahead, but without much knowledge of electricity. Yes, he admitted shamefacedly, he'd been tampering with the works . . . "re-adjusting the relays" . . . playing with it.

Our man gave the boy a brief lecture on the need for letting well enough alone . . . suggested to the superintendent that the boy be required to study the instruction book. It was done.

That was eighteen months ago. Latest word is, "The Keller has been running smooth as silk . . . control box locked up . . . has had no attention except periodic dust removal."

* * *

Most of the small amount of Keller trouble we've had boils down to that . . . well-meant tampering by inexpert hands. The solution is as simple as that . . . keep them away from it. There's nothing delicate about the Keller . . . run it the way the instruction book says, and you'll get plenty of production with no regrets.

PRATT & WHITNEY
Division Niles-Bement-Pond Company
West Hartford, Connecticut.

PRATT & WHITNEY

MACHINE TOOLS ★ SMALL TOOLS ★ GAGES

WEST HARTFORD CONNECTICUT

Basic Accuracy for Mass Production

MEMO to the SMALL Manufacturer

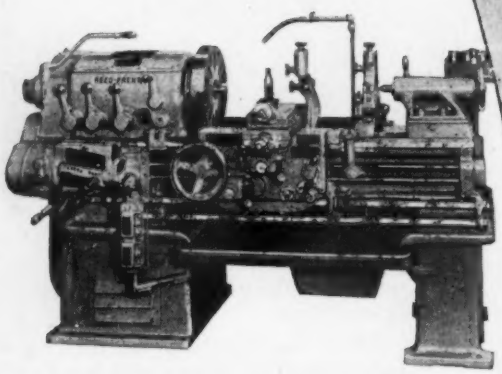
The demand for machine tools for war production is levelling off. A grand job of tooling war plants has been done by the machine tool builders. Inevitably the accomplishment of this job has been detrimental to the small manufacturer who is only secondarily connected with the war effort. Yet the small manufacturer still continues to be the backbone of business. He employs hundreds of thousands of workers. His efforts stabilize prices and maintain a competitive market. He will absorb the future surplus of labor. His existence is vital.

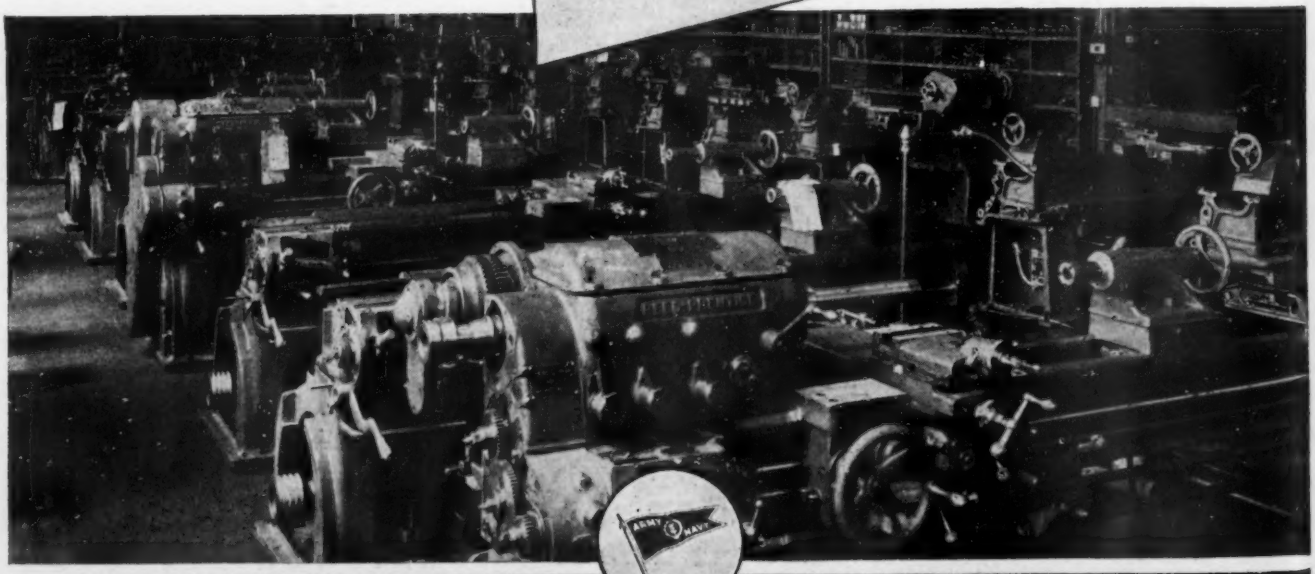
To preserve that existence, worn out and obsolete equipment must be replaced in order to maintain equitable production conditions.

We of Reed-Prentice stand ready to replace those worn out machine tools. Lathes; milling, die sinking and jig boring machines; die casting machines and plastic injection molding machines are Reed-Prentice products.

Send for our catalog or, better still, let our sales engineers diagnose our place in your machine tool requirements.

Reed-Prentice Corp.





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REED-PRENTICE CORP.

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WORCESTER
MASS. U. S. A.

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C & W
SPECIAL PRECISION CUTTERS

Special
High-Speed Steel

COUNTERSINKS
REAMERS
MILLING CUTTERS
RECESSING TOOLS
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For
Aircraft — Gun — War Industries

To meet the demands of the war program — ON TIME — C & W is constantly expanding plant capacity. C & W is one of the largest producers of special high-speed precision cutting tools — and has an outstanding record in meeting promised delivery schedules.

Write for illustrated pamphlet—
Consult us on your tool requirements.

C & W TOOL COMPANY

FOR OVER THIRTY YEARS QUALITY PRECISION CUTTING TOOLS

He Never Has to Take His Eyes Off the Cutter and Work

DEVLIEG JIGMIL

Spindle start, stop and reverse—

Power vertical feed and rapid traverse movement—

Power horizontal feed and rapid traverse movement—

Power automatic table retraction and repositioning—

Power feed and rapid traverse to bar movement—

are all carried in a master switch on the spindle head—at the operator's finger tips.

Thus, the operator of the DeVlieg Jigmil can fix his vision on the cutter and work—never has to look at controls during operation.

The Jigmil is what a machine tool should be—a powerful and accurate extension of the operator's hand. The value in precision boring and milling is apparent.

It's a NEW *Type Machine*

Spacing Accuracy of a Jig Borer . . . Performance Qualities of a Milling Machine . . . Convenience and Flexibility of a Horizontal Boring Mill.

New speed of operation . . . New standards of excellence of bored holes . . . New accuracy in milling . . . Automatic table retraction and repositioning dependable within .0002".

Many machines show 75% greater average daily productivity.

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DE VLIEG MACHINE COMPANY

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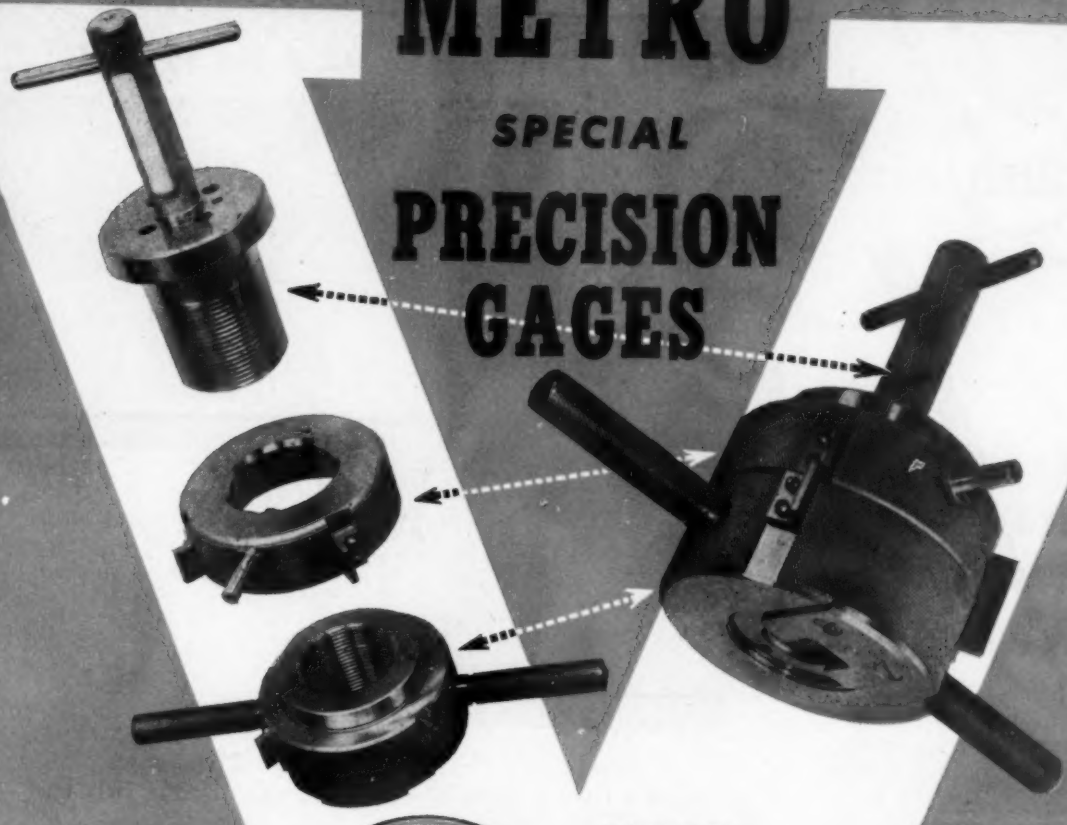

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presenting engineering data which may be helpful to you in selecting the proper gage or carbide tool for your purpose.
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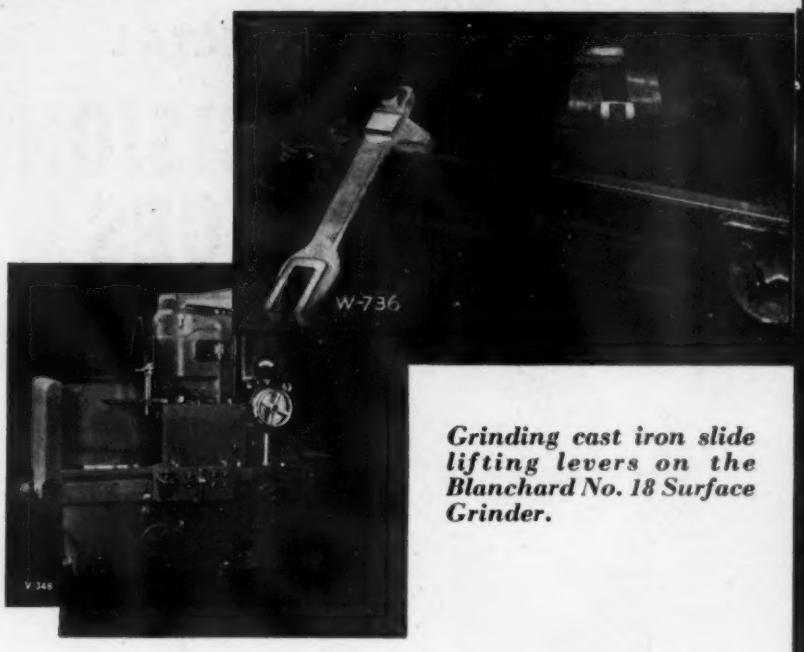
CHECK THESE ADVANTAGES OF BLANCHARD GRINDING



Grinding cast iron slide lifting levers on the Blanchard No. 18 Surface Grinder.

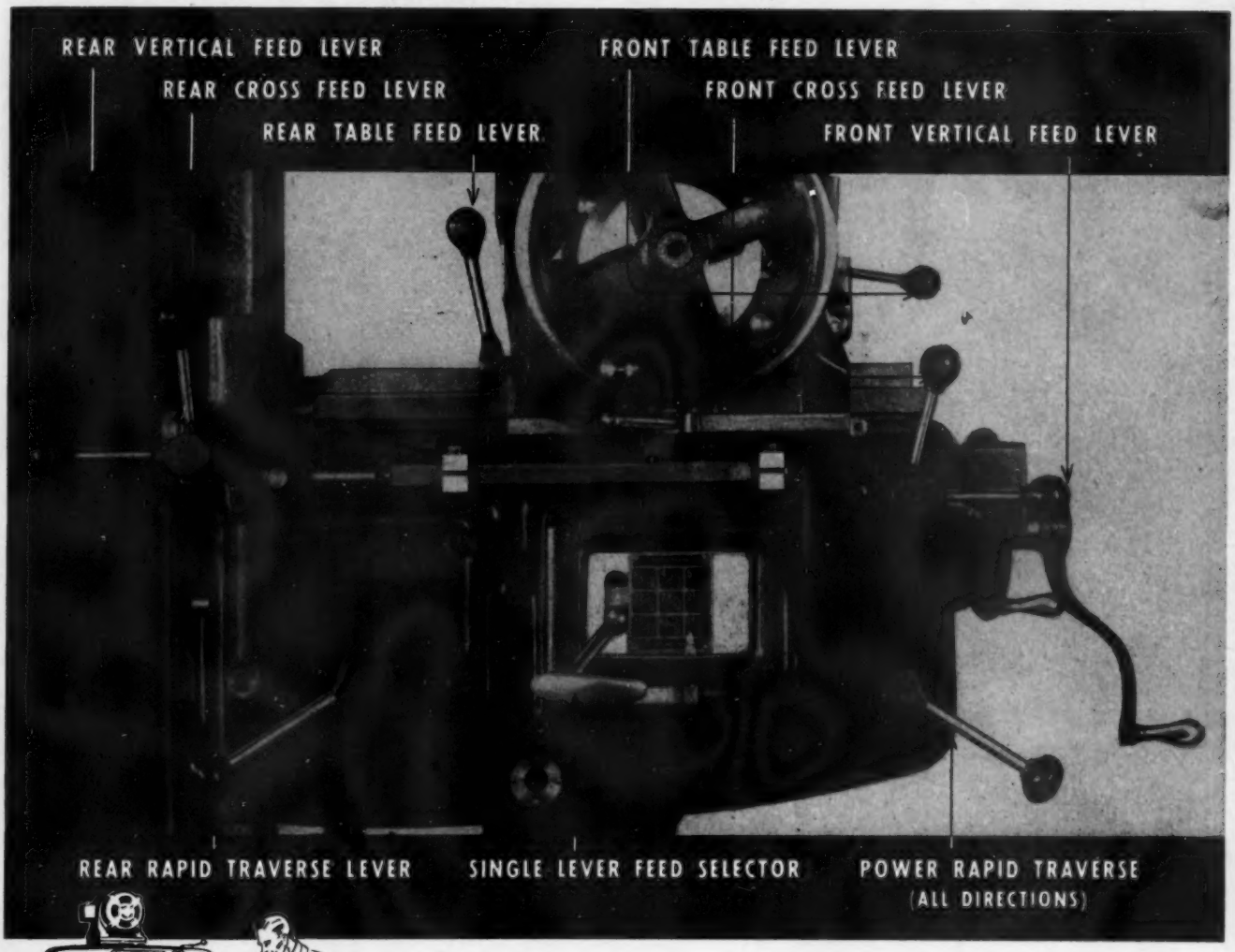
AT FIRST GLANCE this does not look like a job for the Blanchard No. 18 on account of the projecting boss. The problem was solved simply enough. The lever is laid on the chuck so that the boss goes through the hole in the center of the chuck. The outer surface, which is lower than the inner surface, is ground. The wheel is then raised, the chuck moved in, and the inner surface is ground. The lever is then turned over and a .290" size block is placed under the ground forked end to make it level with the other end, and both surfaces are finished.

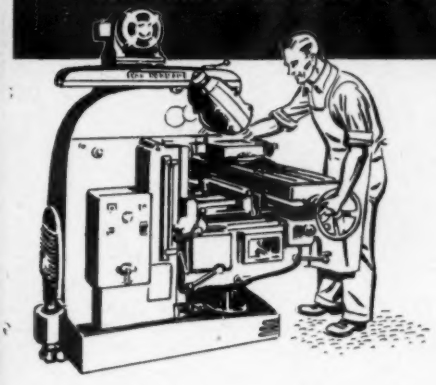
3/16" of stock is ground off each side to limits of +.002". 8 pieces (16 surfaces) are ground per hour.

★ . . . . . *Especially valuable on jobs like the one illustrated.*

The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.





VAN NORMAN CONTROLS ARE EASY TO REACH AND USE . . . Save Time and Lessen Fatigue

An operator working at the front or back of a Van Norman Milling Machine can readily reach a full set of power controls without going around to the other side of the machine. These controls are conveniently grouped and easy to use. They are *directional* in motion and remove any chance of confusion, because the levers are moved in the same direction in which the operator wishes to move the table, knee and saddle,—left or right, up or down. Illustrated bulletin sent on request. Write on your business letterhead.

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MACHINE TOOL COMPANY, SPRINGFIELD, MASSACHUSETTS, U. S. A.

Horton chucks

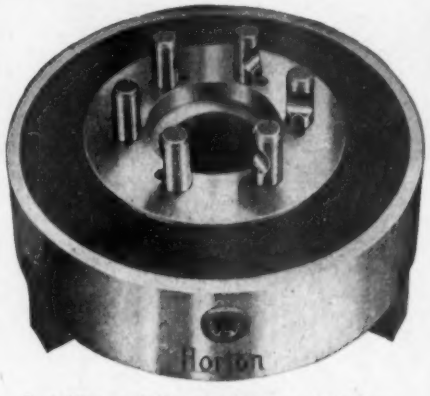
INDEPENDENT Solid Reversible Jaws Only

SCROLL UNIVERSAL Two-Piece Jaws Only

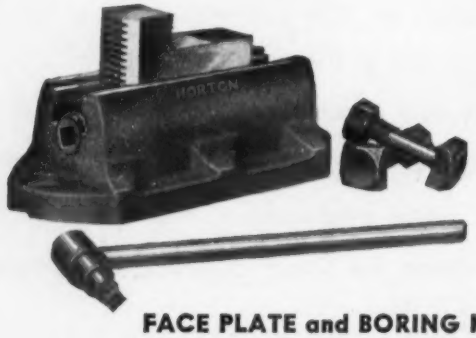
For Use With Intermediate Plates On Threaded Spindles

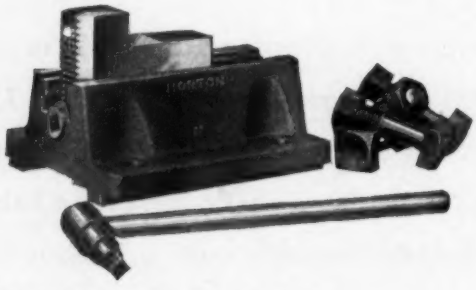
For Key Drive Tapered Nose Spindles

War Production Limited To These Essential Chucks



For Flanged Tapered Nose Spindles
Illustration shows Chuck for Type D (Cam Lock) Spindle





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FACE PLATE and BORING MILL JAWS—Steel Body Only

SINCE 1851 .... THE E. HORTON & SON CO.

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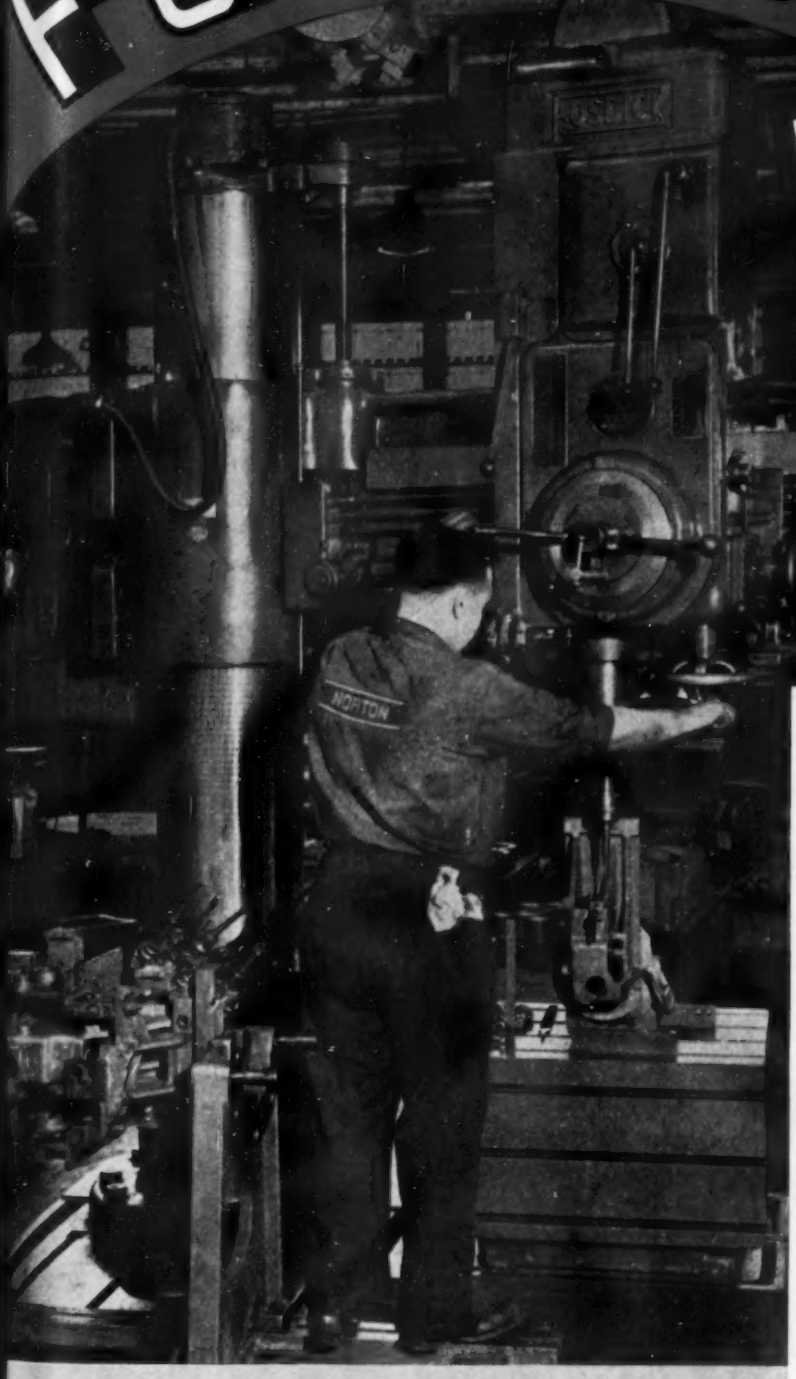
FOSDICK

flexibility proves a real asset



● "One of the best of all the Radials we have," that's how the foreman of a well known manufacturer of grinding machines feels about the Fosdick Hydraulic Radial illustrated.

Two set-ups are required to perform all the operations on this cast iron Table Traverse Apron. A jig is used for locating holes on four sides of the work and a clamp on the work table is used for holding piece for remaining operations.

Following are operations performed:

Drill and tap — 11 holes 5/16" and 18 5/8" holes.
Tap 17 holes — other sizes standard thread.
Tap 2 holes — 3/8" pipe thread.
Ream 1 hole 1" dia. — 2 holes 1/2" dia.
1 hole — drawback spot face.
1 hole — spot face.
5 holes — counterbore.

The foreman also says "Heavy ball-bearing spindle is very accurate — centralized controls provide all necessary operating speeds — large diameter column and arm section prevent deflection."

If you want flexibility of operation — continued accuracy — ease of operation — and low costs, put your radial jobs on a Fosdick Hydraulic Radial.

Our bulletin Fosdick Hydraulic Radials R.A. gives complete details. Write for yours.

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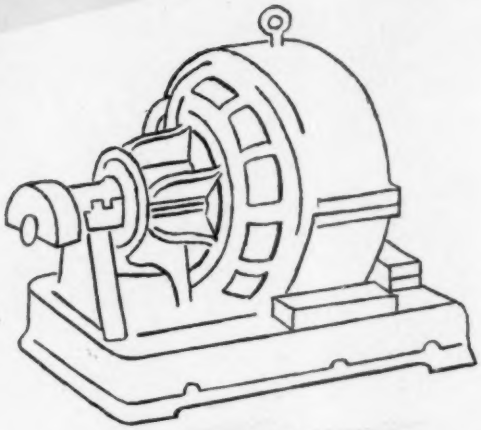
CINCINNATI . . . OHIO

salvage searched



to replace broken shovel motor-shaft in one day's time

SHAFT ON 37 HP SHOVEL MOTOR SNAPPED AT 4:00 P.M. FRIDAY. MOTOR RECEIVED AT WESTINGHOUSE DISTRICT MANUFACTURING AND REPAIR PLANT 11:00 A.M. SATURDAY. STEEL FOR NEW SHAFT COULD NOT BE DELIVERED PROMPTLY. SEARCHED SALVAGE AND MACHINED LARGER MOTOR SHAFT TO CORRECT DIMENSIONS. MOTOR ASSEMBLED AND SHOVEL OPERATING AT 4:00 P.M. SUNDAY.

Westinghouse

DISTRICT MANUFACTURING AND REPAIR

J-90467

IF **THE EQUIPMENT NEEDING REPAIR IS VITAL TO THE WAR EFFORT . . . PHONE THE NEAREST OFFICE OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY FOR**

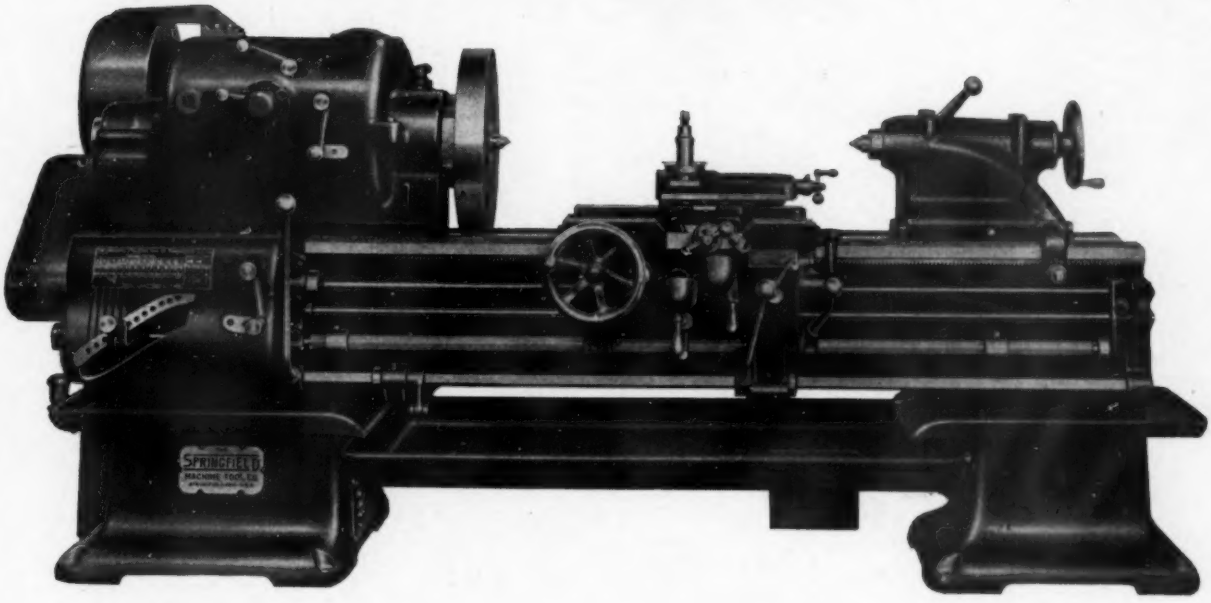
EMERGENCY SERVICE

33 M & R PLANTS . . . ONE NEAR YOU!

FOR CONTINUED ACCURACY OVER A GREAT NUMBER OF YEARS

SPRINGFIELD

PRECISION LATHES



● Extreme accuracy and long life obtained from Springfield lathes is due to the deep, well ribbed bed made from High Test Chrome Gray Iron. Made in our own Foundry, we have found from exhaustive metallurgical and wear tests by professional laboratories and actual operation in the field that this material gives greater wear resistance, freedom from scoring and freedom from internal strains. As a result you get greater accuracy throughout the life of the lathe.

Designed right — built right — and made of scientifically correct materials — Springfield lathes are giving continued accuracy over a greater number of years.

Thinking in terms of heavy production demanded in war times and for the peace time output to follow, you can't go wrong with a Springfield Lathe. Sizes range from 14" to 30".

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.

HA-HA! HE THOUGHT A SNAKE BIT HIM! I DON'T SEE HOW A GUY COULD BE ABSENT-MINDED ENOUGH TO THINK THAT A SNAKE WOULD BE IN A BIG MODERN PLANT LIKE THIS!
THAT'S JUST TH' REASON! IT'S SO MODERN THAT ONLY A FEW MONTHS AGO WE WAS PICKIN' WILD BERRIES RIGHT ABOUT HERE -- AND THERE WAS SNAKES IN TH' BUSHES!
T. M. REG. U. S. PAT. OFF.
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MEMORY LANE
J.R.WILLIAMS
3-5

THAT WAS THE DAY HE TALKED THE BOSS INTO "CHIP BREAKERS."

Chip Control avoids dangers and delays caused by long, hot, tough chips of alloy steel. Chip Control yields **short chips** that are more marketable, bring a better price, and provide a means for speedy recovery of alloys on a national scale.

For a proved method of producing **short chips** with Firthite Sintered-Carbide Cutting Tools, refer to pages 41, 42, and 43 of the Firthite Users' Handbook. Ask for Handbook FE-101.

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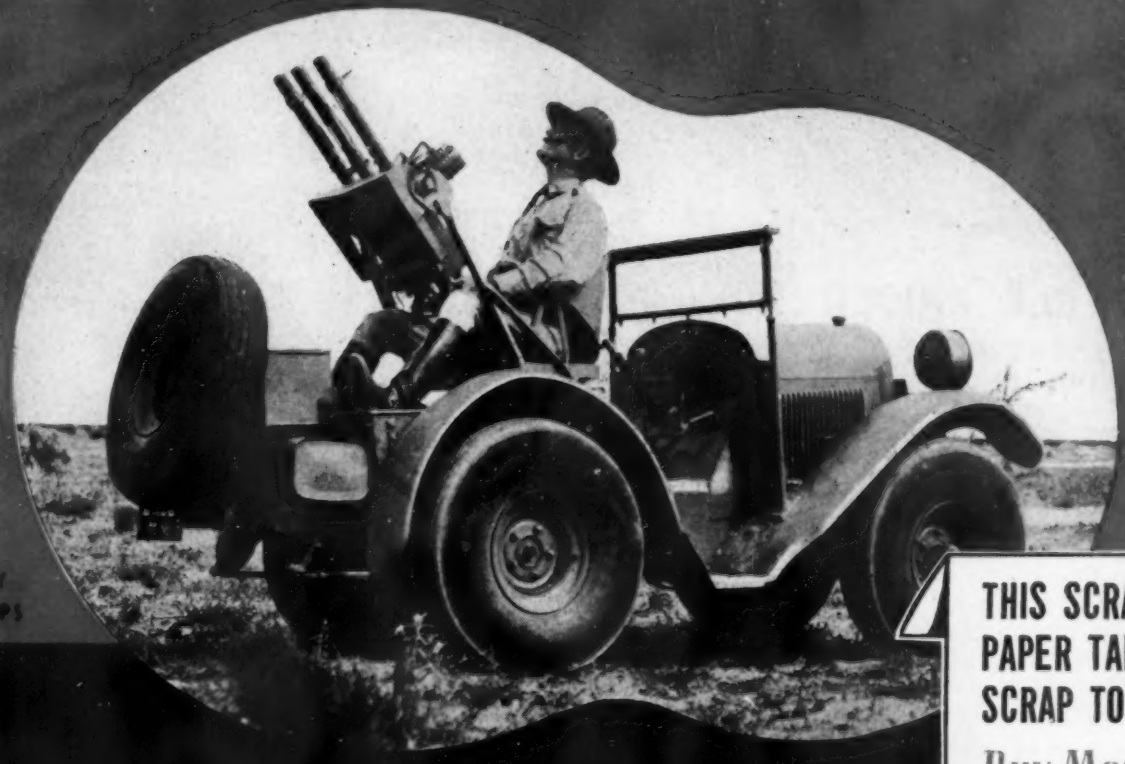
Firth-Sterling
STEEL COMPANY
Offices McKEESPORT, PA. NEW YORK · HARTFORD · PHILADELPHIA · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

Speed on the production line with

P&J

AUTOMATIC CHUCKING EQUIPMENT

Accelerates delivery of our guns to the firing line



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Duplicate parts—for airplanes, airplane engines, tanks, Bofors guns, 90 mm anti-aircraft guns, machine guns, adaptors for shells, the American Aerlikon gun and other products of war—are being turned out at big time savings on P&J equipment. Accuracy and speed are being maintained with a minimum of man-power because P&J Automatic Chucking Equipment can be operated in batteries with one attendant serving several machines at the same time.

P&J pioneered the development of machines for producing duplicate parts. Today, P&J is able to throw more than forty years experience into the job of "achieving the impossible." If production figures were permitted here they would be almost unbelievable in the light of past performance, excellent as it was in pre-war days.

P&J offers its experience to help you solve your production problems.

POTTER & JOHNSTON MACHINE COMPANY
Pawtucket, R. I.

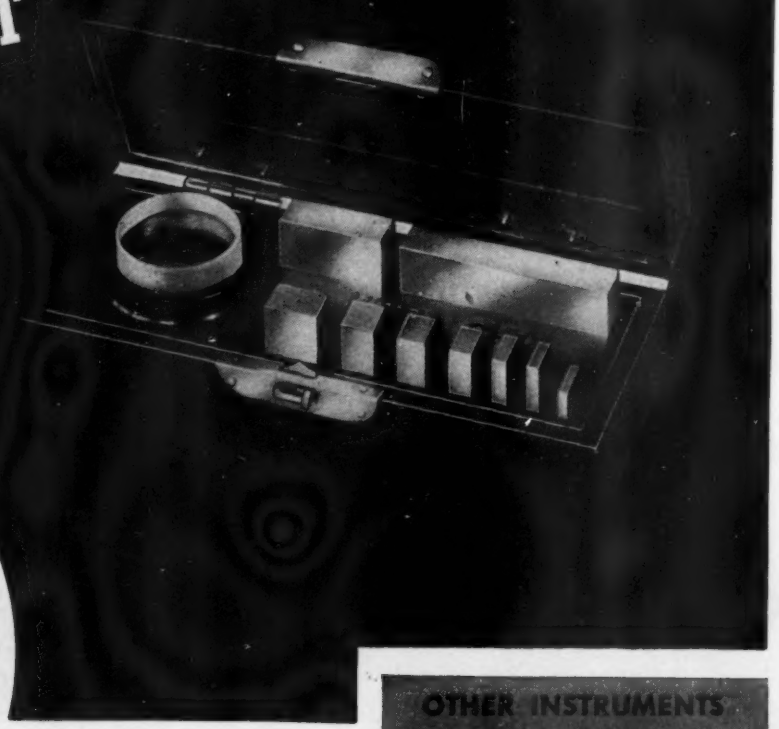
THIS SCRAP OF PAPER TAKES THE SCRAP TO THEM

Buy More
WAR BONDS

The 9-Block ULTRA-CHEX SET

makes more than 300 combinations

in steps from .100" to 4.5"



ULTRA-CHEX provides the means for making exact settings of micrometers, dial indicators, comparators and other instruments so that reliable measurements can be obtained.

REASONABLY PRICED

The standard 9-Block ULTRA-CHEX set, consisting of .0625" - .100" - .125" - .200" - .250" - .300" - .500" - 1" - 2" blocks, will enable you to bring together blocks of various sizes to form 331 combinations. With this set, all sizes of micrometers up to 4" can be checked in various steps and lead errors quickly and accurately detected and checked.

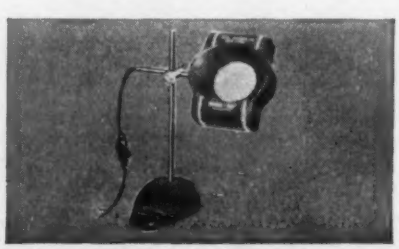
ULTRA-CHEX precision length standards offer the answer to many measuring problems. Eight millionths accuracy is available in this set at a price within the reach of any shop man. Toolmakers, mechanics, die-makers and machinists will find in this ULTRA-CHEX set the means of producing tools, jigs, fixtures or parts to the closest tolerance limits specified.

The material used in ULTRA-CHEX is specially seasoned to relieve all hardening strain and to make the blocks impervious to size change except that due to wear in long service. Surfaces are perfectly lapped and checked by Optical Parallel and adhesion test.

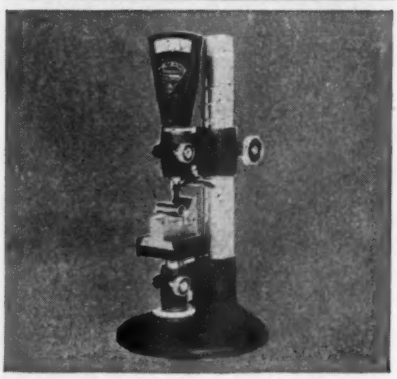
Price Per Set of 9-Blocks (with Optical Flat) $27.50

Price Per Set of 9-Blocks (without Optical Flat) $19.50

ULTRA-CHEX sets are also available in several other block combinations. Full *details on request.*



OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY

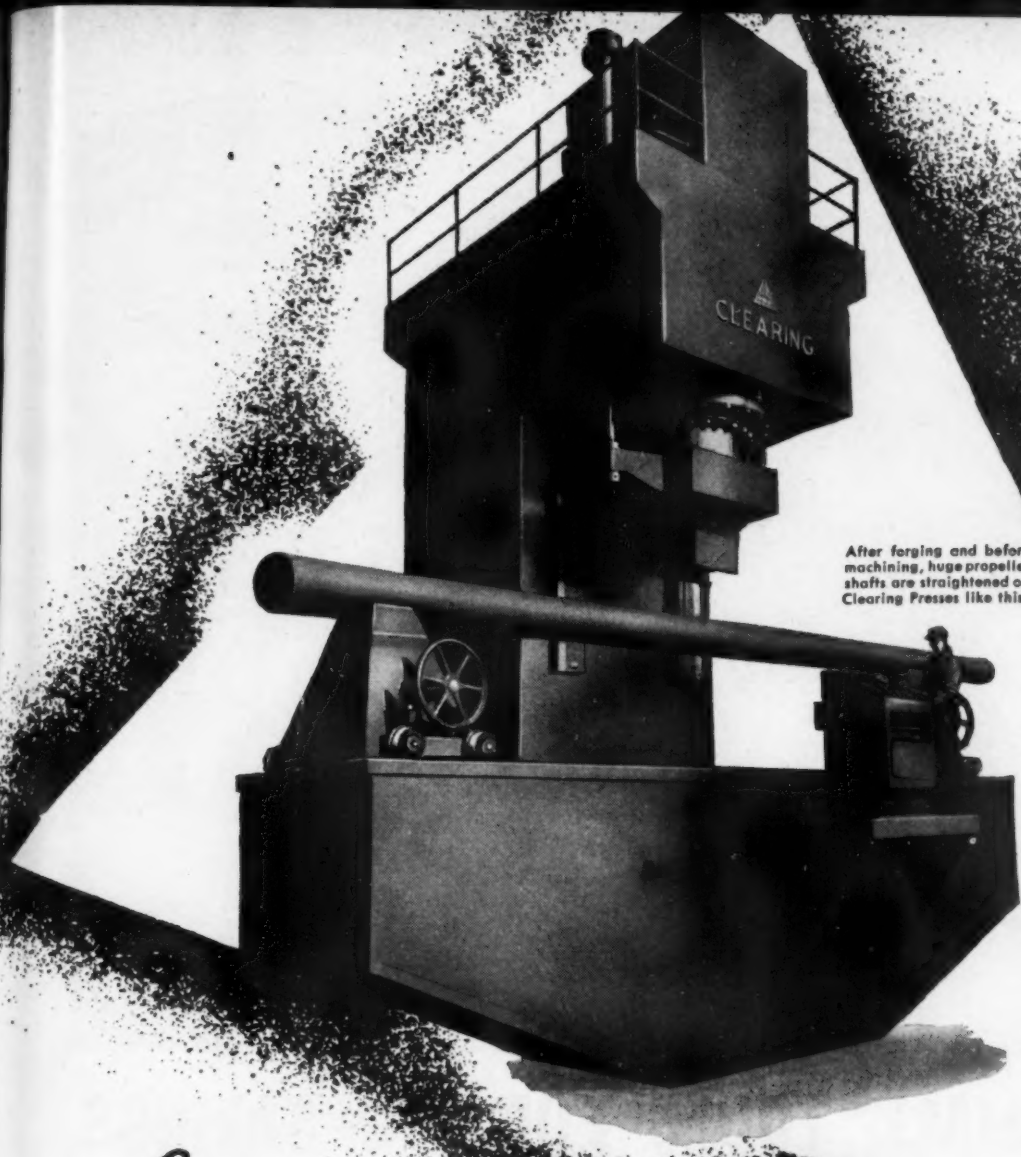


Scherr Comparitol — for checking gage blocks, gages and work for size, accuracy and wear.

At'antic Adjustable Limit Snap Gages— for accurate check-up, without having to depend on operator's skill. Sizes to 6".

Magni-Ray—a wide field illuminated magnifier for close inspection work and operations.

GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.

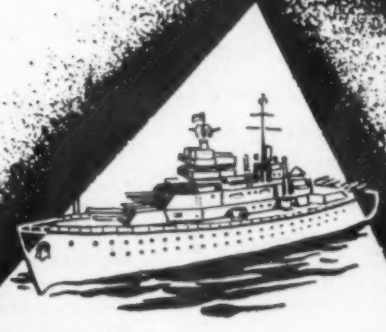


After forging and before machining, huge propeller shafts are straightened on Clearing Presses like this.

Gentle GIANT

Massive solid steel shafts weighing up to 100 tons each have their warps and bends removed on huge Clearing presses like this. So powerful is the Clearing giant above . . . an 1800 ton capacity Gap Type Press . . . that it is used to straighten even the 32" diameter propeller shafts of America's newest ships. Yet so gentle and responsive is this giant that essential accuracy is easy to achieve. Because of the unusual construction of the electrically driven shaft manipulators, speed in work is readily obtained. A shaft may be rotated, raised or lowered, or moved lengthwise over the bed. Hand-operated anvils are positioned to suit the work.

The Gap Type Press is another solution to press problems that Clearing engineering and production facilities have supplied to industry. Consult Clearing whenever the question of presses comes up . . . you'll find it pays. CLEARING MACHINE CORPORATION 6499 West 65th Street, Chicago, Illinois.



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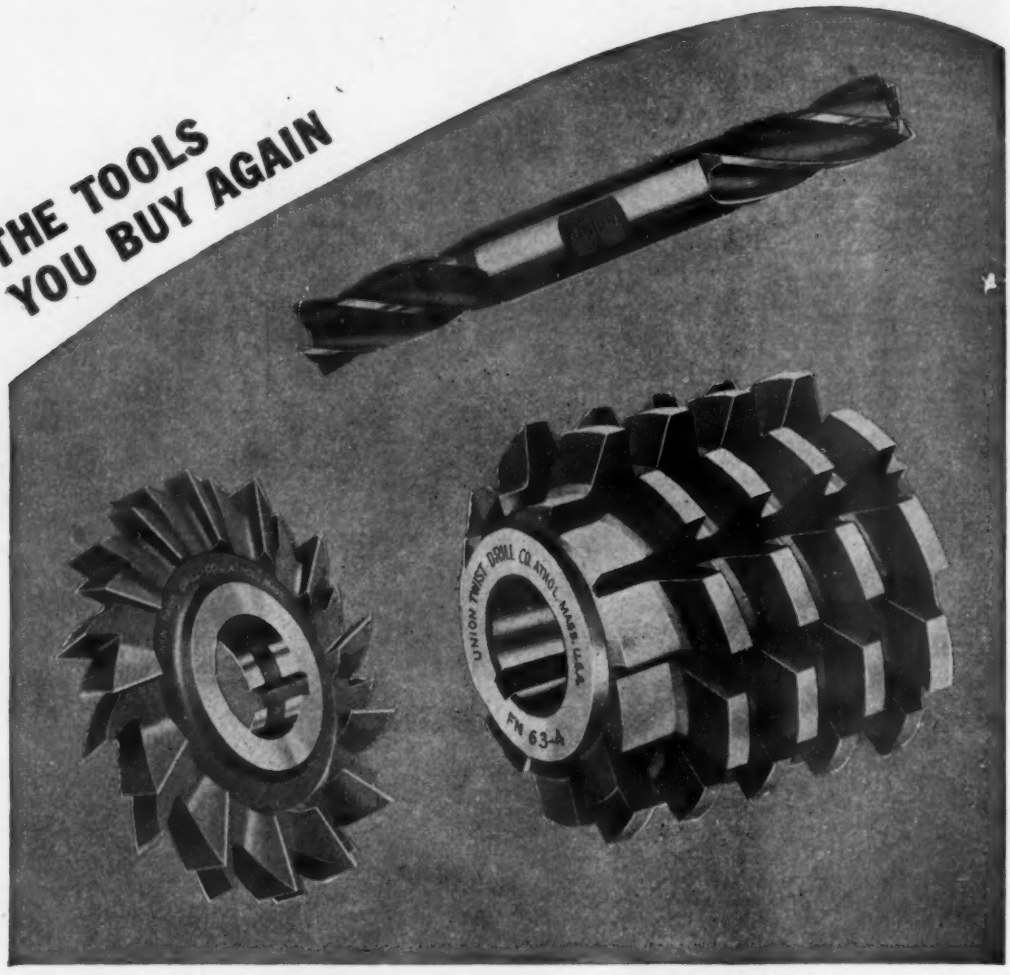
CLEARING PRESSES

MECHANICAL AND HYDRAULIC

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies—Screw Plates— Profile Cutters.



SMALL TOOLS FOR BIG SAVINGS

Union's eminent position in the small tool field is the result of the meticulous care taken in the selection of materials, specialized and competent metallurgical experience, modern manufacturing facilities and rigid inspection. Small tools by Union make big savings in cutting time, assure accuracy and more cuts between grinds because every care is taken in every phase of production to realize faster cutting, higher cutting efficiency and more economical results.

You can buy UNION TOOLS on faith—and you'll continue to use them for performance.

UNION TWIST DRILL COMPANY

ATHOL, MASS.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

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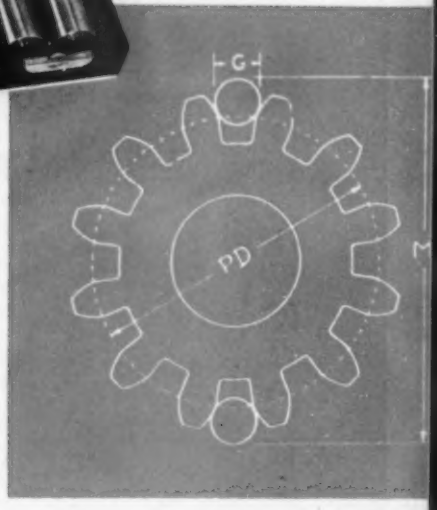
Representatives throughout the world

UNION

Set No. 26 External Gear Measuring Wires for use with new simplified gear measuring system.



SIMPLE, RELIABLE, SUPER-ACCURATE!

Van Keuren GEAR MEASURING SYSTEM

Simple! . . . The only calculation required is one of simple division.
Reliable! . . . The system is based on formulas approved by the American Gear Manufacturers Associaion.

Super-Accurate! . . . Van Keuren Gear Measuring Wires are accurate to within 25 millionths of an inch for roundness and exact size.

Van Keuren gear measuring tables give the measurements (M) over the wires (G) for 1 diametral pitch gears of correct pitch diameter (PD). The only calculation required is to divide the measurement for 1 diametral pitch by the diametral pitch of the gear being measured. The tables are complete for gears from 10 to 171 teeth and for pressure angles of 14½° 17½°, 20°, 25° and 30°. The tables provide for measuring both external and internal gears. They are far more accurate than anything previously available. No interpolations are required.

Write for catalog No. 31, giving full details, complete tables and instructions for their use.

Our Catalogue No. 31 is a manual of precision measuring systems, giving complete tables and simplified formulas for measuring all standard threads, splines and spur gears. Send for this valuable handbook.

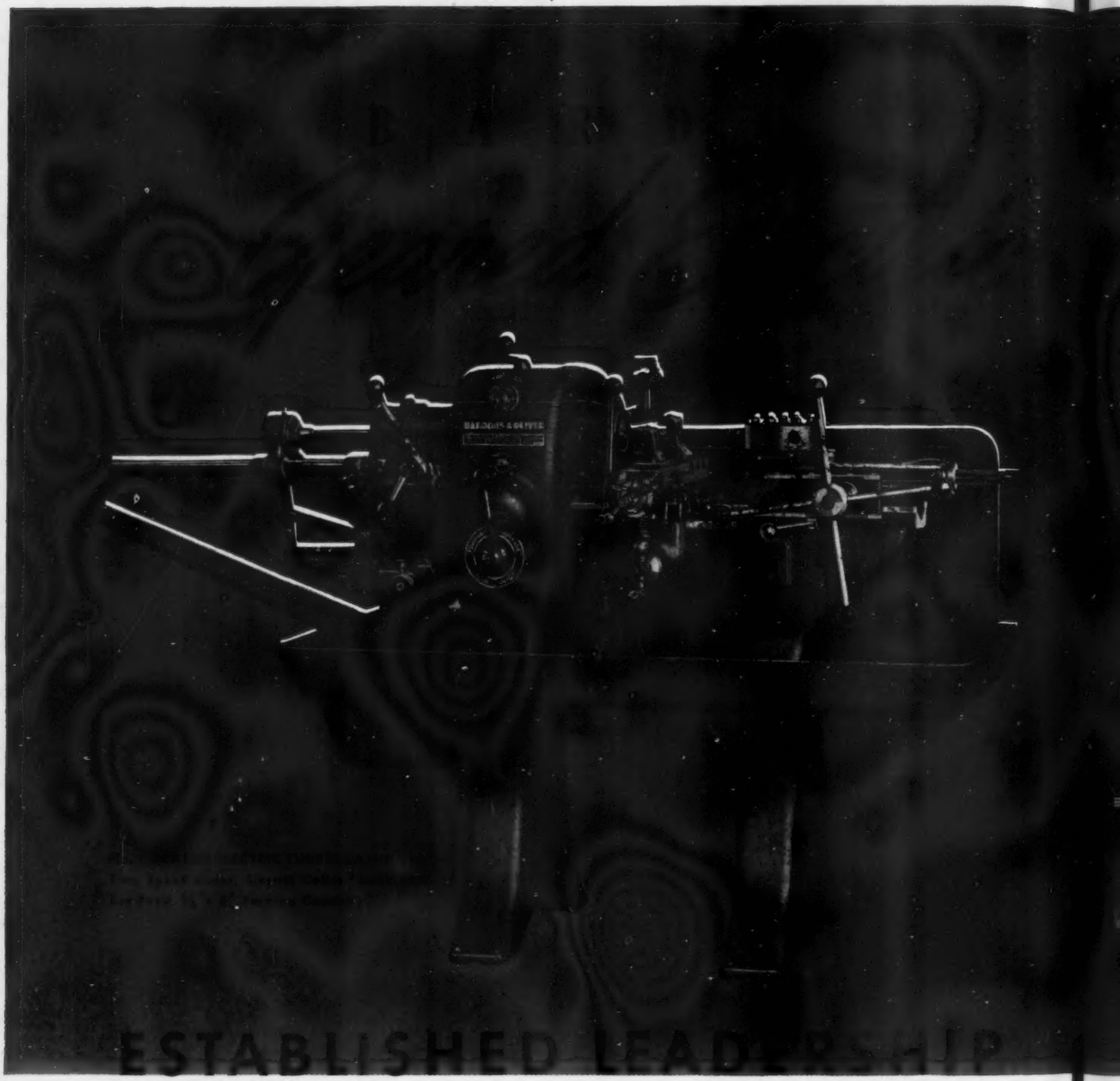
Ultimate Accuracy

Van Keuren

24th YEAR

THE VAN KEUREN CO., 176 WALTHAM ST., WATERTOWN, MASS.

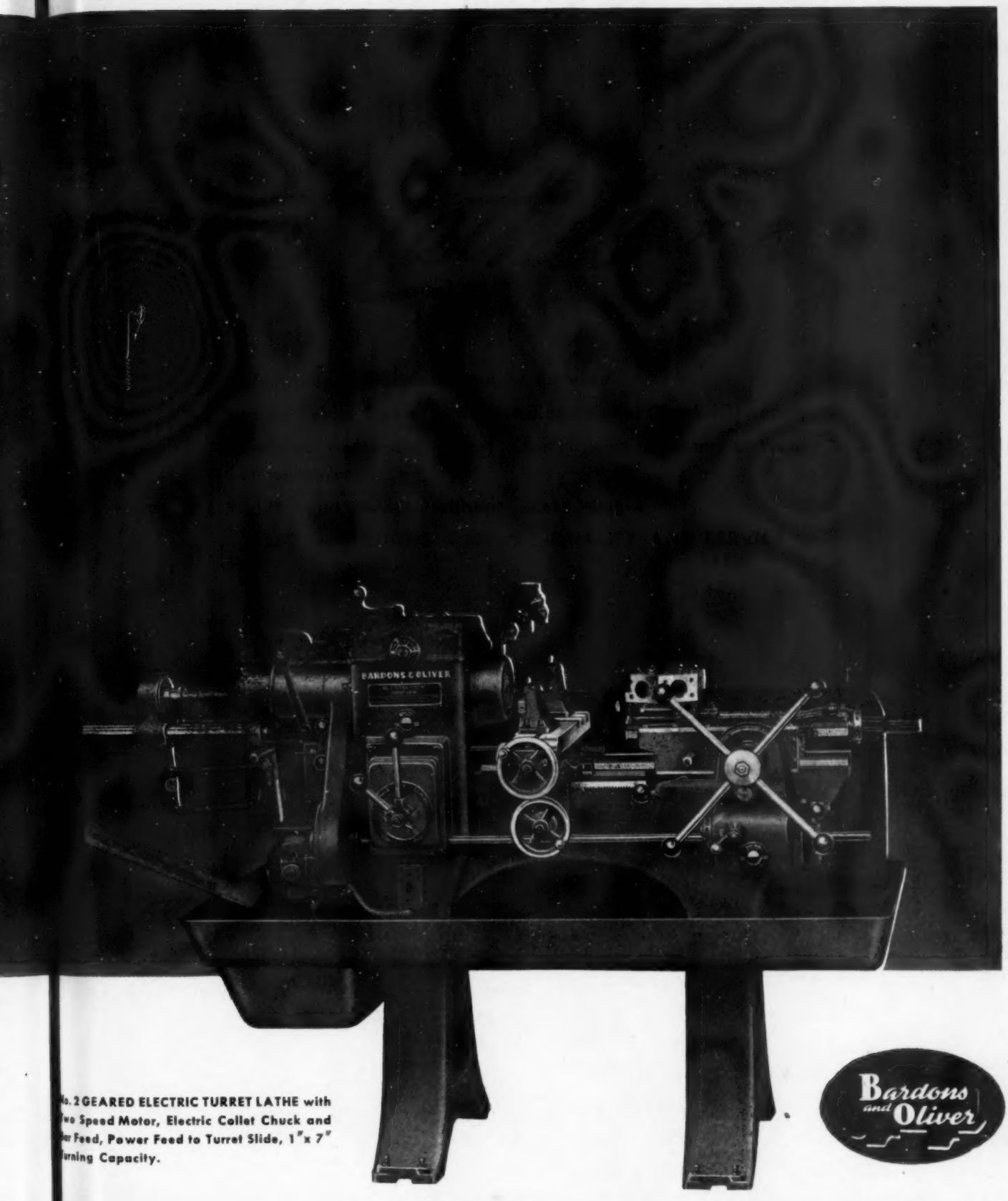
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages
Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles



ESTABLISHED LEADERSHIP

IN THE SMALL TURRET LATHE FIELD

1. **High Spindle Speeds (up to 3500 R. P. M.)**
2. **Six Speed Changes through Sliding Gears with Single Lever Control and Direct Reading Dial. (Twelve Speed Changes with Two Speed Motor)**
3. **20 to 1 Speed Range without the Use of Pickoff Gears**
4. **Optional Speed Ranges to Suit Individual Requirements**



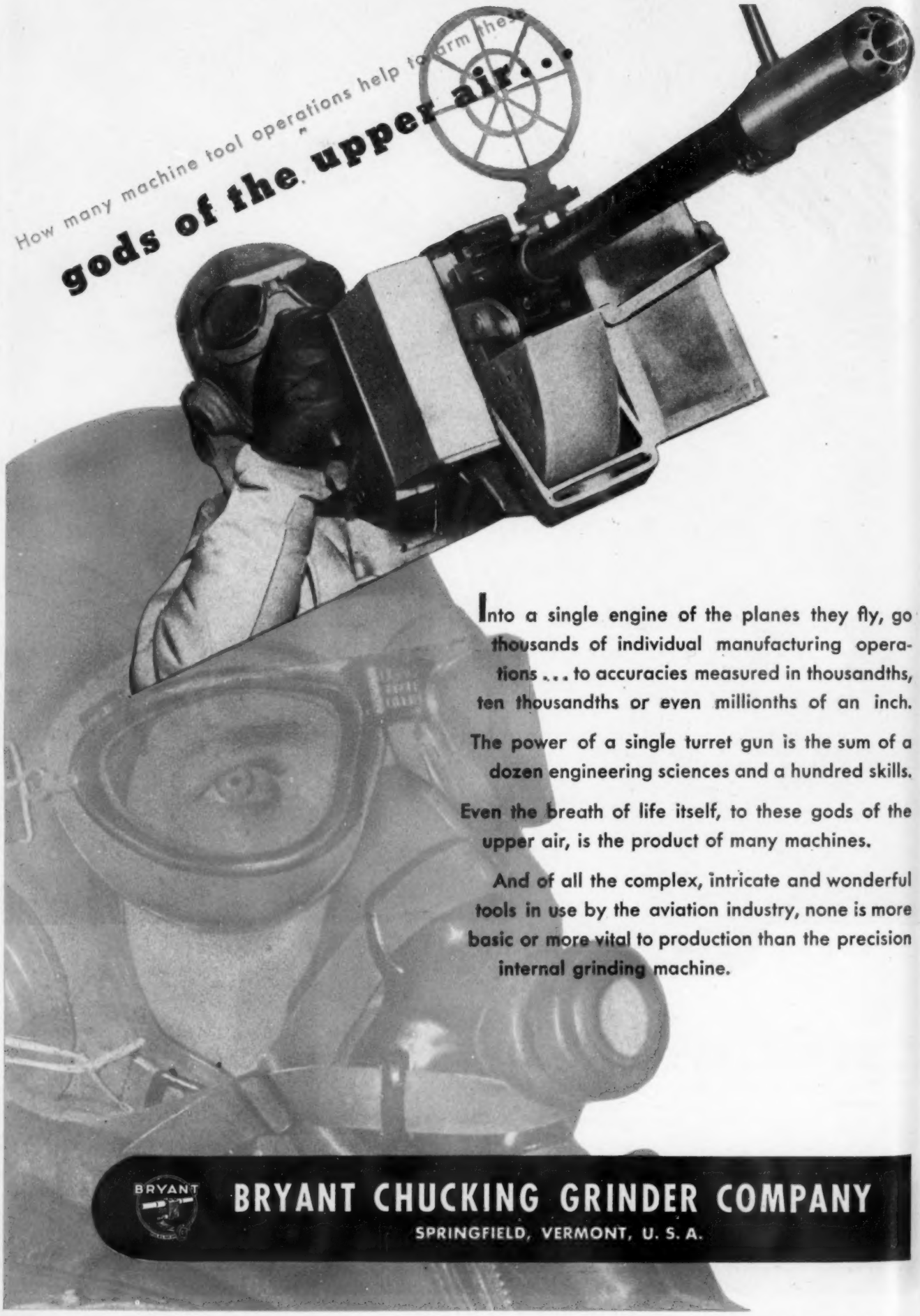
No. 2 GEARED ELECTRIC TURRET LATHE with Two Speed Motor, Electric Collet Chuck and Bar Feed, Power Feed to Turret Slide, 1"x 7" Turning Capacity.

Bardons and Oliver

1133 W. 9th STREET CLEVELAND, OHIO

How many machine tool operations help to arm these

gods of the upper air. . .



Into a single engine of the planes they fly, go thousands of individual manufacturing operations . . . to accuracies measured in thousandths, ten thousandths or even millionths of an inch.

The power of a single turret gun is the sum of a dozen engineering sciences and a hundred skills.

Even the breath of life itself, to these gods of the upper air, is the product of many machines.

And of all the complex, intricate and wonderful tools in use by the aviation industry, none is more basic or more vital to production than the precision internal grinding machine.

BRYANT

BRYANT CHUCKING GRINDER COMPANY

SPRINGFIELD, VERMONT, U. S. A.

When tolerances run into fractional thousandths

★

IT'S A JOB FOR A SIDNEY LATHE ★ ★ ★

Aside from its convenience of operation the outstanding reason for the continued accuracy of the Sidney Lathe is its smooth flow of power.

The superior qualities of continuous tooth herringbone gearing have long been recognized and are most successfully demonstrated in the Sidney Herringbone geared headstock.

Airplane manufacturers were quick to take advantage of this feature of Sidney Lathes—as verified by the large batteries of these modern machines now turning out thousands upon thousands of precision parts daily in a number of prominent airplane plants.

The machine illustrated is working day and night in the plant of a well known manufacturer of aircraft for our fighting forces.

In war as in peace you can depend upon Sidney accuracy.

Built in 14" to 36" capacities—adaptable to a wide range of applications. *Bulletins available on each model.*

SIDNEY

THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO, U.S.A.

The SIDNEY MACHINE TOOL *Company*

Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

AMERICAN
DRILL WIZARD
THE AMERICAN TOOL WORKS CO.
CINCINNATI, U.S.A.
AMERICAN
FOR
ALL-OUT
PRODUCTION
LATHES
RADIALS
SHAPERS

Manpower Shortage

CAN BE MET

and PRODUCTION MAINTAINED

with

"AMERICAN" *Hole Wizard* RADIALS

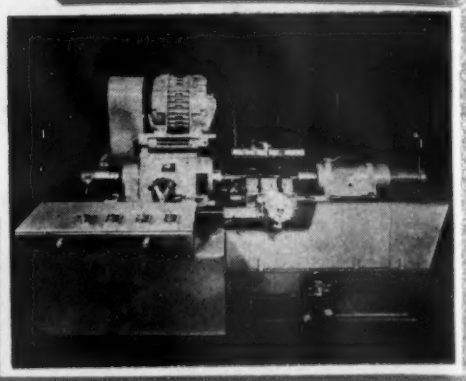
Give an operator a modern machine tool such as the "AMERICAN" Hole Wizard and in many cases he can duplicate the output of two equally efficient men handling the same job on two old, out-moded machines. Furthermore, control convenience features of the modern machine enable the operator to maintain his production schedule with a minimum of manual effort.

Achievement of all-out production need not be handicapped by shortage of manpower when "AMERICAN" RADIALS, with their greater speed, capacity, accuracy and convenience are installed to replace obsolete machines.

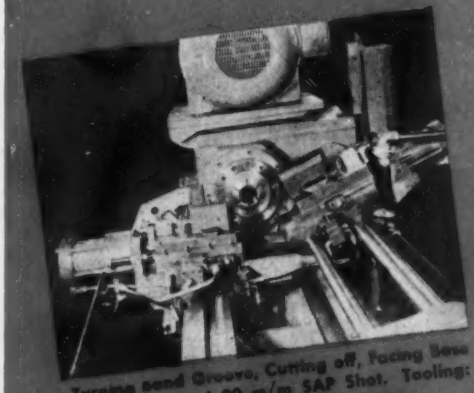
The AMERICAN TOOL WORKS CO.

Cincinnati, Ohio

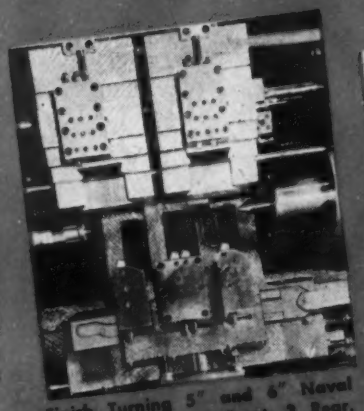
Multiple tooling set-ups for MASS PRODUCTION on the SPARKS SEMI-AUTOMATIC HYDRA-FEED LATHE



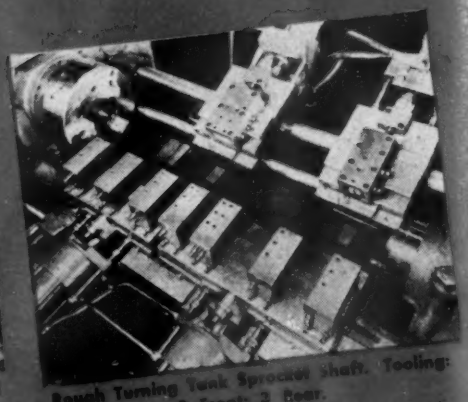
VERSATILITY for a WIDE VARIETY of WORK



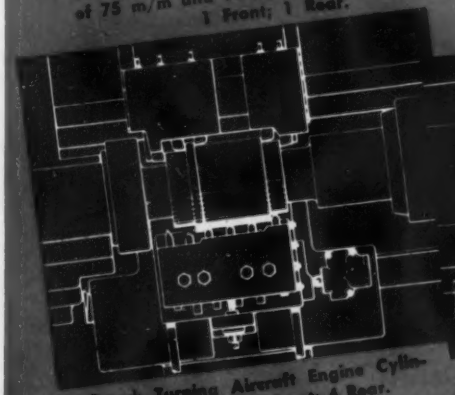
Turning Sand Groove, Cutting off, Facing Base of 75 m/m and 90 m/m SAP Shot. Tooling: 1 Front; 1 Rear.



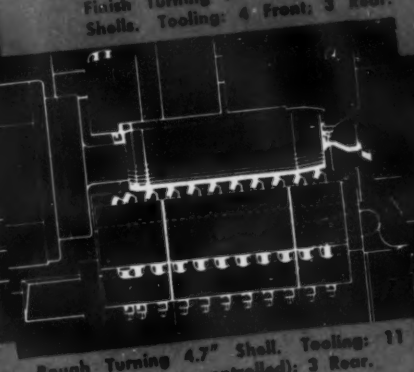
Finish Turning 5" and 6" Naval Shells. Tooling: 4 Front; 3 Rear.



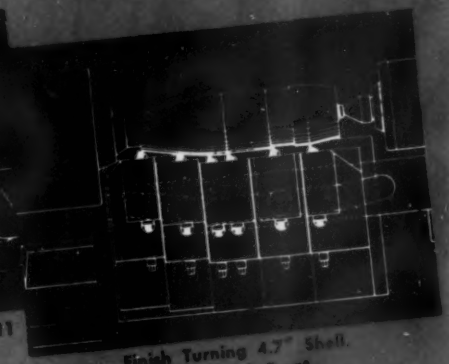
Rough Turning Tank Sprocket shaft. Tooling: 8 Front; 3 Rear.



Rough Turning Aircraft Engine Cylinder. Tooling: 6 Front; 4 Rear.



Rough Turning 4.7" Shell. Tooling: 11 Front (2 cam controlled); 3 Rear.



Finish Turning 4.7" Shell. Tooling: 6 Front.

The combination of multiple tooling with the application of hydraulic power for producing and controlling inter-related tool movements results in a machine of outstanding mass production capabilities.

The typical examples of tool set-ups shown here have been proved effective, efficient and highly productive in actual service. Further details are available on request.

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

SPEED UP PRODUCTION

WITH SOUTH BEND LATHES

Time saved on production speeds the delivery of vital matériel to our fighting forces. Now, on the home front, it is a fight to the finish for maximum production.

South Bend Lathes can help you speed up production on toolroom and manufacturing operations. They have dependable precision, a wide range of speeds and feeds, and the strength and rigidity for effective use of tungsten carbide tools. Their ease of operation also contributes to their efficiency.

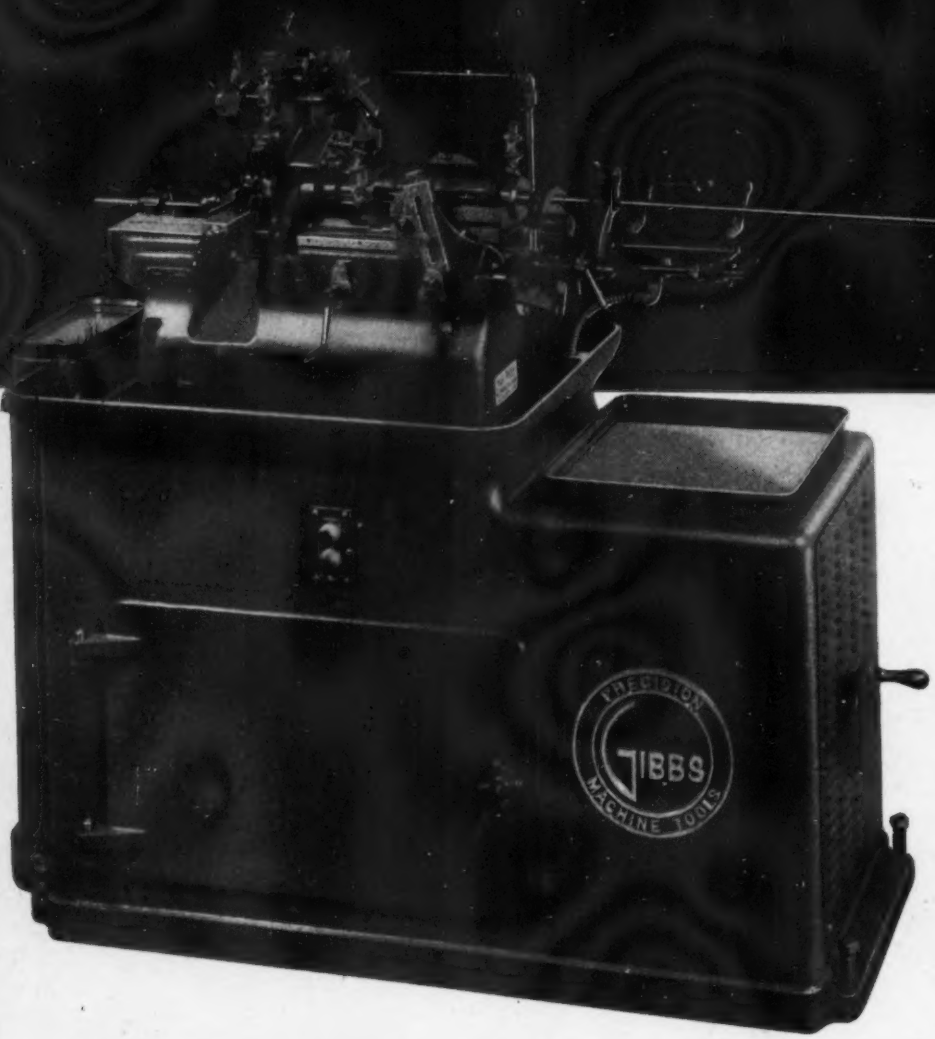
South Bend Engine Lathes and Toolroom Lathes are made in five sizes ranging from 9″ to 16″ swings, with bed lengths from 3′ to 12′. The Turret Lathes have 9″ and 10″ swings. Catalog 100C will be mailed upon request.

★ BUY U. S. WAR BONDS ★

16″ swing, South Bend Toolroom Lathe

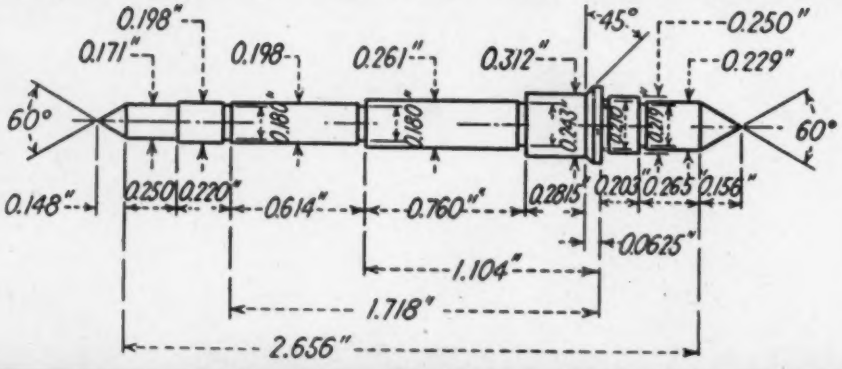
SOUTH BEND LATHE WORKS • *Lathe Builders for 36 Years* • South Bend, Indiana

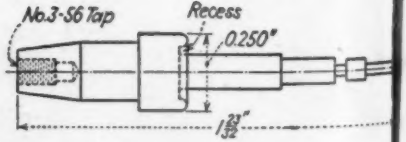
the story



- ★ Automatic operation from bar stock to finished piece.
- ★ High speed (and low cost per piece).
- ★ Extreme accuracy.
- ★ High finish.
- ★ Easy to operate — safe.
- ★ 5 cutting tools and 5 attachments.
- ★ Modern — to meet your present and future production needs.

The GIBBS will do all of these operations





Submit any small piece problem to Dept. 5 . . . no obligation to you

THOMAS B

DIVISION OF THE

y can be told!

It's the GIBBS MODEL 375 AUTOMATIC SCREW MACHINE

YES — now the story can be told . . .

Although scores of leading manufacturers have been using the Gibbs 375 Automatic Screw Machine for some time to turn out amazingly intricate small parts in literally hundreds of different shapes . . . this is the *first time* it has ever been advertised!

In this perfected machine tool is the tailor-made answer to any problems you may have in turning out small pieces automatically, at high speed, low cost, and with only moderately skilled operators.

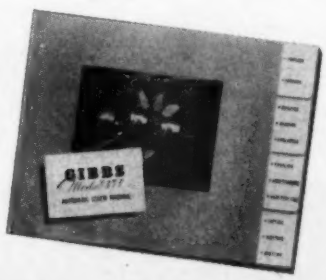
Turning . . . forming . . . drilling . . . reaming . . . threading . . . knurling . . . counterboring . . . undercutting . . . tapping . . . slotting . . . spotting — the Gibbs Automatic does the whole job for you with extreme precision . . . *consistently to tolerances of .0002".*

Built with 5 cutting tools and 5 attachments, the Gibbs is a high-speed machine that "walks away" from anything you have ever seen.

Here, then, is a completely *modern* automatic screw machine . . . actually a postwar machine tool NOW! That's why — if your problem is to turn out small intricate parts from bar stock — it will pay you to find out how the Gibbs 375 Automatic Screw Machine can save you time, labor, and money both *now* and in the *postwar period to come.*

GET ALL THE FACTS!

Write for booklet A-101 describing how the Gibbs 375 may help you solve your small parts problems.



"8 months — 24 hours a day of mass precision production"

Here's what one manufacturer of precision parts writes — "Our Gibbs Automatic Lathes have now been in operation continuously in our plant for eight months. These machines are producing small precision parts requiring very close tolerances, and have given very satisfactory results over this entire period. Production has never been interrupted for mechanical repairs in spite of the fact the machines have been running 24 hours daily."

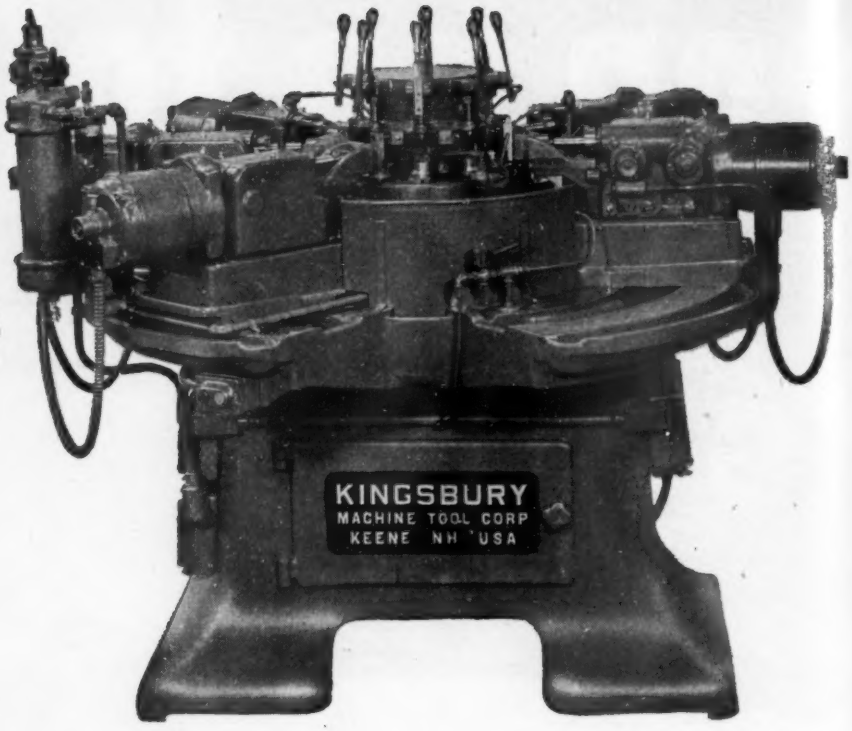
A manufacturer of watch-like parts writes — "With our Gibbs Automatics, we are not only keeping to extremely close tolerances, but we are turning out parts on a production basis, with fewer man-hours per 1,000 pieces. Your attachments certainly fill the bill for letting us do more operations. In our opinion, these attachments make the Gibbs the outstanding automatic on the market."

S B. GIBBS & COMPANY

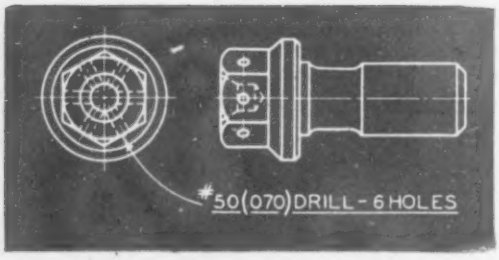
THE GEORGE W. BORG CORP. DELAVAN, WIS.

PRECISION GIBBS MACHINE TOOLS

Loading and Unloading While Drilling assures Continuous High Production



FLEXIMATIC



by KINGSBURY

THIS IS A FLEXIMATIC AIRPLANE JOB!

Kingsbury Standard Units for drilling, reaming, boring, spotfacing and milling can be mounted in any combination, operated automatically and changed over quickly and easily to suit the requirements of the work to be handled.

This is six-spindle **FLEXIMATIC** is set up for drilling lacing holes in the heads of screws for airplane motors. High production, so essential to parts involved in the speeded up program of this important phase of National Defense, is being achieved with minimum effort on the part of the operator.

The main turret of this **FLEXIMATIC** contains eight individual turrets which index 60° at each index of the main turret. Each of the six automatic drilling units on the machine drill a hole from the outside face of the hex head into the center only. The operator merely loads and unloads at the loading station while the holes are being drilled at the other stations on the machine. All six drilling operations are performed in a single chucking of the work.

Speed, convenient handling, accuracy and continuous production are universally recognized advantages offered by **FLEXIMATICS** regardless of the nature of the job assigned them to handle. The specific work being performed here is typical of many others where **FLEXIMATICS** are the machines for jobs calling for the maximum in time savings.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U S A

Compare—and You'll Pick Ampac!

It makes a big difference which a-c welder you pick today. See how much more new Allis-Chalmers Ampac "200" gives you in better, faster work!

Compare 4 leading types of Transformer Welder in their Use of 11 Important Features . . .

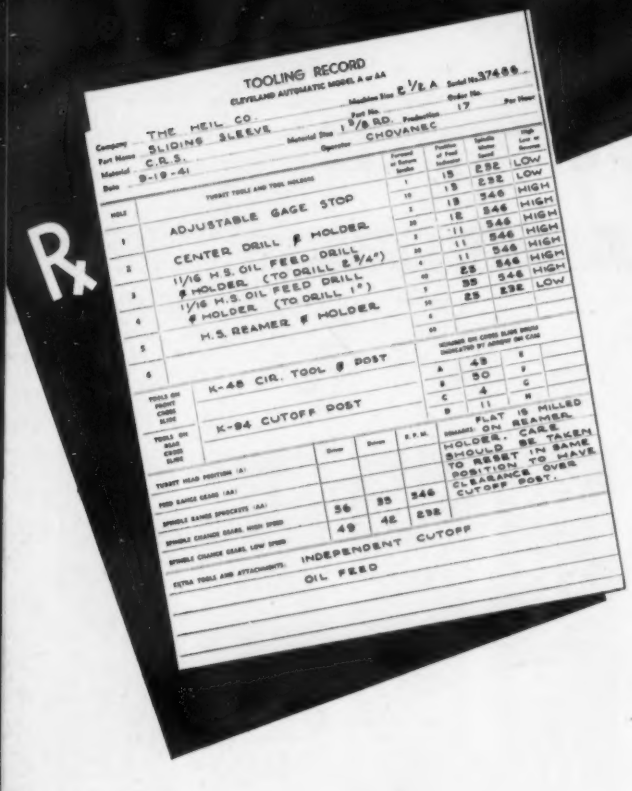
IMPORTANT FEATURES	HOW THEY BENEFIT YOU	AMPAC "200" (Integrated moving core type)	WELDER "B" (Moving coil type)	WELDER "C" (Moving core type)	WELDER "D" (Shunt type, moving core)
1 No arc blow to slow down welding.	Steady arc makes sound, uniform welds. You can weld in corners and grooves easily. Production is speeded.	YES	YES	YES	YES
2 Low striking voltage at high amperage.	Saves power for you. No need for high voltage at high currents. Raises power factor — cuts power input.	YES (65 volts)	NO (75 volts)	NO (75 volts)	NO (75 volts)
3 High striking voltage at low amperage.	Strikes arc fast. Gives you high, yet safe voltage necessary. Makes a-c welding easy at low currents.	YES (78 volts)	NO (72 volts)	NO (75 volts)	NO (75 volts)
4 Takes less than 300 sq. in. floor space.	Small size saves valuable space on crowded shop floors . . . makes it easier for you to move and handle the unit.	YES (281 sq. in.)	NO (361 sq. in.)	NO (398 sq. in.)	YES (288 sq. in.)
5 Contains less than 5 wearing parts.	Cuts maintenance to simple lubrication twice a year. Less chance for wear means longer service, lower upkeep.	YES (4 parts)	NO (8 or more)	NO (6 or more)	NO (8 or more)
6 Low original cost (no rotating element).	Simpler construction of a-c welder cuts purchase price to around 65% of what you would pay for a d-c welder!	YES	YES	YES	YES
7 Wide welding range of over 200 amperes.	You can weld thin sheets . . . yet have capacity for heavy plates, too. You can use rods from 1/16" to 1/4" in size!	YES (220 amp)	YES (215 amp)	NO (195 amp)	NO (195 amp)
8 Reconnectable for 220-440 & 208 v., 60 cycle.	Gives you full capacity at low voltages where lines are long and isolated. Can be used on *any* standard a-c voltage!	YES	NO (220 or 440)	NO (220-440 only)	NO (220-440 only)
9 Over 85% efficiency at normal loads.	You enjoy *full* benefits of a-c welding: lower power loss, high power factor, lower operating costs!	YES	NO	YES	YES
10 All settings within six control turns.	Saves welding time. Welder can make simple adjustment from high to low amperage current quickly and easily.	YES (6 turns)	NO (50 turns)	NO (30 turns)	NO (15 turns)
11 Movement of variable part 2" or less.	Cuts wear and maintenance to a minimum. Reduces hum and vibration Contributes to trouble-free operation.	YES (1 inch)	NO (9 inches)	NO (6 inches)	YES (2 inches)
	Only Ampac gives you all 11 . . . TOTALS	**11** Ampac "200"	**3** Welder "B"	**3** Welder "C"	**5** Welder "D"

ALLIS-CHALMERS AMPAC "200"

WRITE ALLIS-CHALMERS, MILWAUKEE, WIS., FOR COMPLETE INFORMATION

A1619

Prescription for


TOOLING RECORD
CLEVELAND AUTOMATIC MODEL A or AA
Company THE HEIL CO.
Part Name SLIDING SLEEVE
Material C.R.S.
Date 9-19-41
Machine Size 2 1/2 A
Part No. 37489
Material Size 1 5/8 RD.
Production 17
Order No.
Operator CHOVANEC
TURRET TOOLS AND TOOL HOLDERS
ROLL
1 ADJUSTABLE GAGE STOP
2 CENTER DRILL # HOLDER
3 11/16 H.S. OIL FEED DRILL # HOLDER (TO DRILL 2 3/4")
4 11/16 H.S. OIL FEED DRILL # HOLDER (TO DRILL 1")
5 H.S. REAMER # HOLDER
6
TOOLS ON FRONT CROSS SLIDE
K-48 CIR. TOOL # POST
TOOLS ON REAR CROSS SLIDE
K-94 CUTOFF POST
Driver
Driven
R.P.M.
TURRET HEAD POSITION (A)
FEED RANGE GEARS (AA)
SPINDLE RANGE SPROCKETS (AA)
SPINDLE CHANGE GEARS, HIGH SPEED 56 35 246
SPINDLE CHANGE GEARS, LOW SPEED 49 45 232
EXTRA TOOLS AND ATTACHMENTS: INDEPENDENT CUTOFF OIL FEED
Formed or Screw Blanks
Position of Feed Indicator
Spindle Motor Speed
High, Low or Reverse
1 15 232 LOW
2 15 232 LOW
3 15 246 HIGH
4 12 246 HIGH
5 11 246 HIGH
6 11 246 HIGH
7 25 246 HIGH
8 25 232 LOW
9
10
HOLDERS FOR CODED BLANK SPACES INDICATED BY ASTERISK ON CODE
A 43 F
B 50 J
C 4 G
D 11 H
REMARKS: FLAT IS MILLED ON CAGE. REAMER HOLDER SHOULD BE TAKEN TO RESET IN SAME POSITION TO HAVE CLEARANCE OVER CUTOFF POST.

Camco's newest booklet, describing the full Cleveland line of Single Spindle Automatics, has just been released. It contains information you will find interesting, whether you are production man or president.

COSTS very often get out of control on jobs which, for one reason or another, go into production and out . . . and back again. Set-up time, even on modern machines, can run up the bill, as every production man knows.

That's just another kind of a job on which Cleveland Universal Camming can make surprising savings. In the first place, *set-up time per operation* is reduced to a remarkable minimum by the simplicity and accessability of all controlling cams. Secondly, the speed with which Clevelands *complete several operations* is such that savings over other methods *commence with the first few pieces* finished and increase in proportion to the number produced.

Because of the accurate scaling and simple adjustments of the universal cams which control all operations, the set-up man can keep an exact record of every setting. This he uses as a sort of "prescription", if the job goes back on the machine, to re-tool with a great saving over the original set-up time.

That's the sort of saving that contributes to profitable production.

Remember, Clevelands Cut Costs

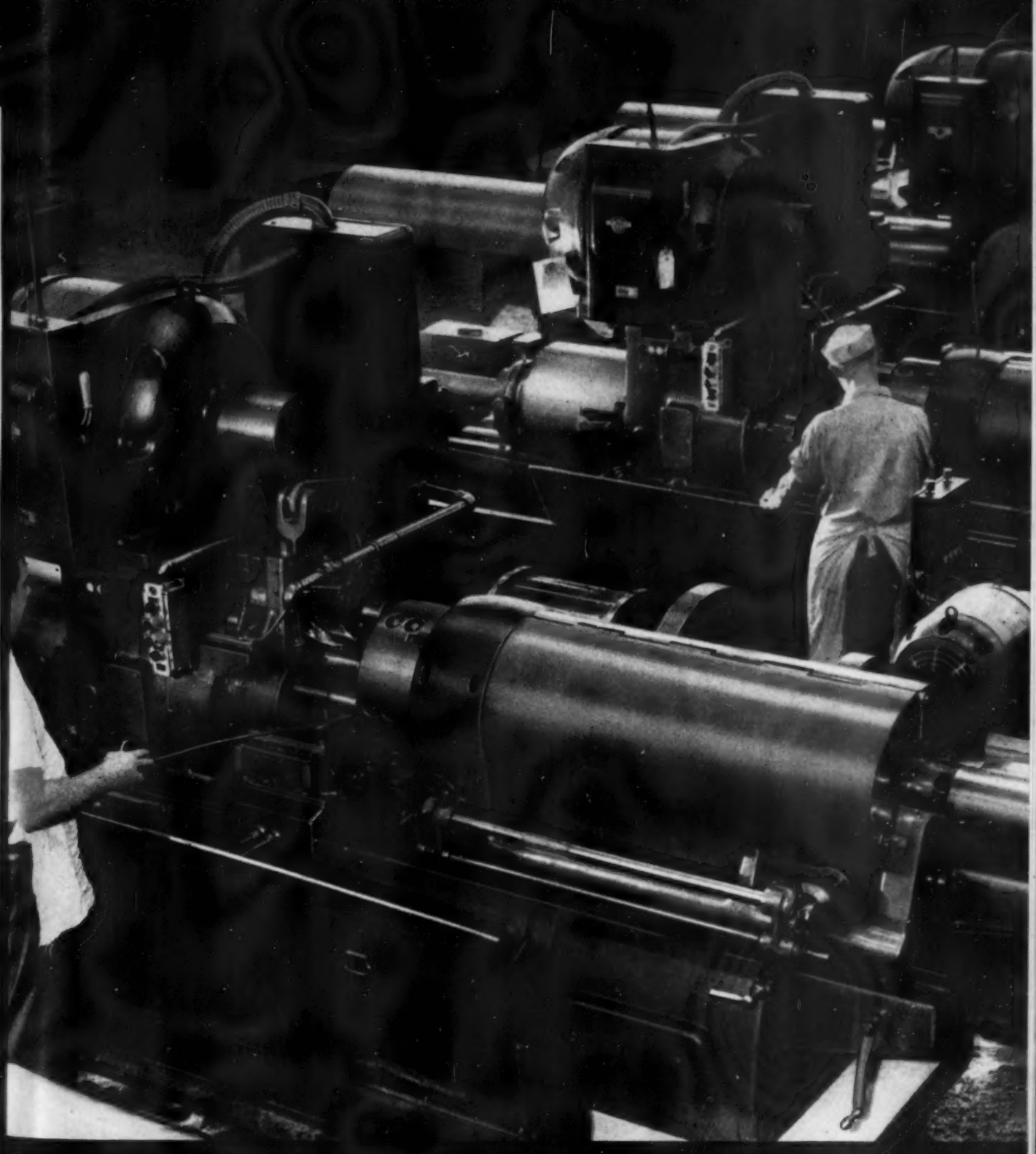
THE CLEVELAND AUTOMATIC MACHINE COMPANY

CLEVELAND, OHIO

SALES OFFICES

CHICAGO: 1408 Civic Opera Building
DETROIT: 540 New Center Building
NEWARK: 902 American Insurance Building
CINCINNATI: 1315 American Building

Profitable Production

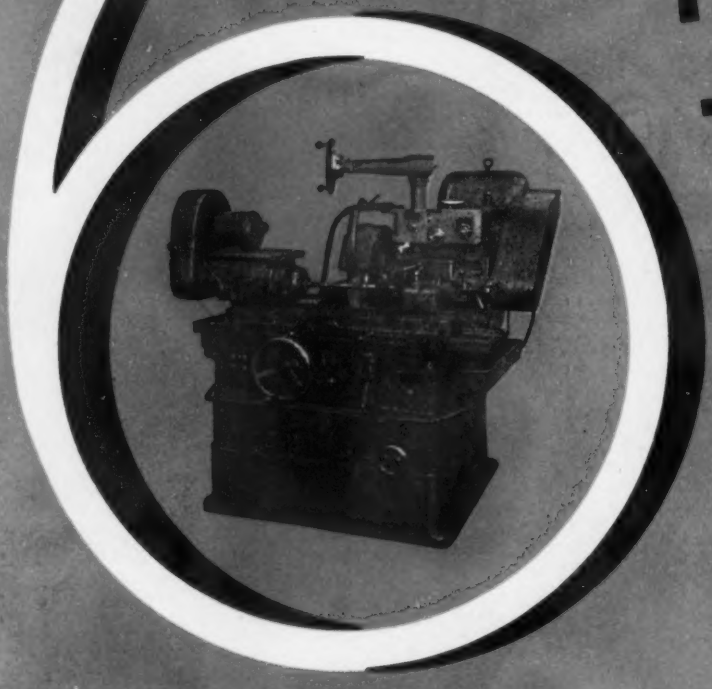


CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 9 1/2-inch capacities

MODEL B—Built in 9/16-inch to 2 1/2-inch capacities

FITCHBURG TYPE "B" GRINDER



New 6" Plain Cylindrical Automatic Precision Grinder

The Fitchburg Type "B" 6-inch automatic precision grinder features new engineering principles that result in more economical production of plain cylindrical parts. It is designed for greater accuracy and finer finish—with completely automatic cycles—rapid traverse to work, correct feed, grinding dwell and rapid return. In fact, it is equipped with every modern feature necessary to normal or wartime production.

So versatile is this grinder that its production adaptability permits both small lots of parts or continuous repetitive work to be handled with efficiency and economy. It is a grinder of entirely new design with all mechanisms readily accessible and ease of operation assured by centralized controls.

Write today for complete details and information about machines with 18" and 32" capacity.

FITCHBURG GRINDING MACHINE CORP.

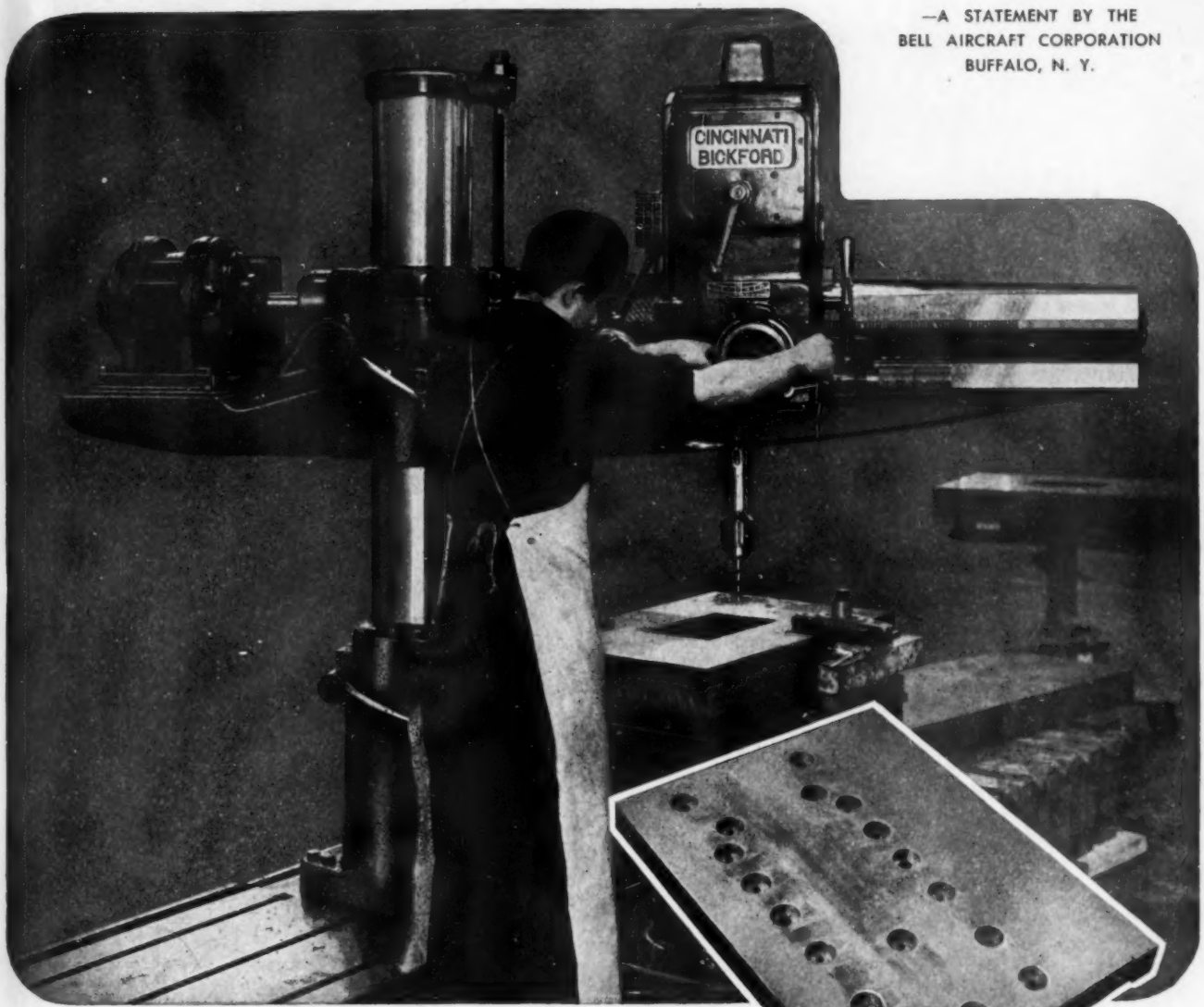
FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders

CINCINNATI BICKFORD SUPER SERVICE RADIAL

is the most accurate and easily handled Radial Drill we ever used . . .

—A STATEMENT BY THE
BELL AIRCRAFT CORPORATION
BUFFALO, N. Y.



The above statement by the Bell Aircraft Corporation refers to countless advantages derived from the Super Service Radial. In this important Defense Plant the Radial illustrated is used primarily for jobs on tools and fixtures where accuracy, speed and ease of handling are advantages of extreme value. Applied to many such operations—and more generally to quantity production—the numerous Cincinnati Bickford Super Service Radials in service today are proving their value as one of America's leading Tools for Defense. Bulletin R-21A lists all features and gives complete details.

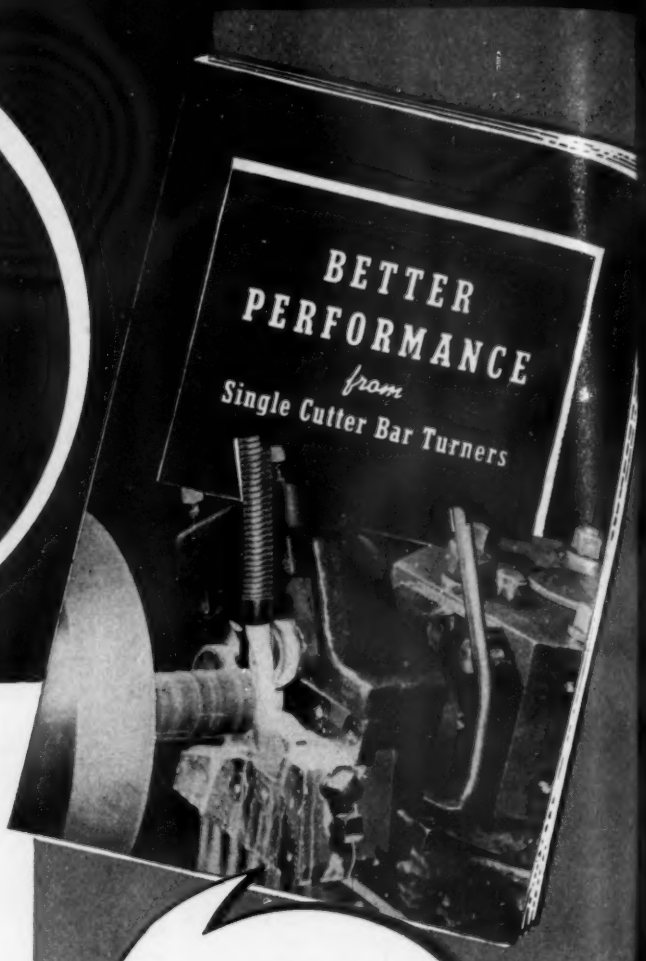
ARMY E NAVY
AWARDED SEPT 10, 1942

AWARDED TO
THE CINCINNATI BICKFORD TOOL CO.
SEPTEMBER 10, 1942

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

DO YOU REALLY KNOW YOUR BAR TURNER?



Here's How You Can Learn the Full Possibilities of Your Bar Turner

ONE of the most important tools employed in metal turning is the Warner & Swasey Single Cutter Bar Turner. It is used more than any tool on turret lathes set up for bar work.

Field studies in dozens of plants indicated the urgent need for a better understanding of the several fundamentals governing the setup and operation of this tool.

The information and many helpful hints assembled in the new Warner & Swasey booklet, "Better Performance from Single Cutter Bar Turners", can improve performance of this basic turret lathe tool and increase production in your shop.

Just issued — new 32-page illustrated booklet shows how to make the most efficient use of the Single Cutter Turner on bar work.

GET IT QUICKLY BY USING THE CONVENIENT COUPON

Warner & Swasey Operator's Service Bureau, Cleveland, Ohio

Please send booklet, "Better Performance from Single Cutter Bar Turners".

Name _____

Company _____

Address _____

City _____ State _____

I work at (Company) _____

AM-10

WARNER & SWASEY
Turret Lathes
Cleveland

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

What's in This Issue

HUGO W. LIEBERT

BROACHED BLADES

One big factor in the allied nations' success in winning the battle of the seas has been the rapid production of navy turbines. A vital part of turbine production is the manufacture of the blades. The substitution of broaching for former machining methods is described by Hugo W. Liebert, works manager, Tractor Plants, Allis-Chalmers Manufacturing Company. Page 105.

WALTER L. DAMKOEHLER

AND POLISHING

A companion turbine-blade article to that on broaching is one on polishing practice. Efficient operation of these parts depends on their smooth finish and freedom from scratches. Walter L. Damkoehler, of Allis-Chalmers, tells of the process that makes the blades that way. Page 118.

STRETCHING—A GOOD THING

The aircraft industry has found the stretch press to be an invaluable aid in forming sheet-metal parts. While the principle is an old one, the equipment and method of operation have been greatly improved. C. L. Fenn, chief tool engineer, Edo Aircraft Company, discusses here the making of form blocks. Page 83.

TUBES OF TOMORROW

Six basic functions of the electronic tube are useful to industry. All of them have been put to work, but so far the number of applications is limited. What has already been done, however, points the way to a widespread postwar use of industrial electronic devices. An easily understood summary of the subject appears in this issue. Page 94.

JOSEPH WITCHEY

BETTER BINOCULARS

Speed and precision are combined in automatic lathe operations used in the production of binocular parts. Careful design of cams and tools that bring about these desirable results are described by Joseph Witchey, tool engineer, Westinghouse Electric & Manufacturing Company. Page 92.

FEED VS. THICKNESS

Feeds and speeds for milling machine operations are often based on the feed per tooth, a calculation readily made from the r.p.m. of the cutter, the number of teeth and the amount of table feed. However, this result is not nearly so significant as the chip thickness. Formula and chart are given in an article by F. J. Wintersdorff, Colt's Patent Fire Arms Manufacturing Company. Page 87.

C. A. BLOOM MERL HARKLESS

DODGE DRILLING

In the absence of the most obvious piece of equipment for a given job, a great deal can be done by rigging up a machine not originally intended for the purpose. Such was the experience of the Dodge Manufacturing Company in drilling and tapping stern tubes for Liberty ships. When a horizontal boring mill was not available an improvised set-up was made from a shafting lathe and a standard drill head. The excellent results obtained are described by C. A. Bloom and Merl Harkless. Page 90.

KEEP IT CLEAN

C. W. Smith, research engineer, Detroit Rex Products Company, contributes Part II of his series on metal cleaning. This installment is devoted to aluminum and its alloys. Such materials must be cleaned thoroughly before they can be spot-welded or given a protective finishing coat. Typical equipment layouts are included. Page 97.

COMING

"Rule-of-thumb" has, until recently, played a big part in aircraft fixture design. Now it is yielding to sound engineering methods based on standardized fixture elements and carefully calculated design analysis. One of the leading companies in the industry has worked out a standard which includes basic box sections, joint plates, clamps and other fixture members. The deflection of these parts has been calculated, and tested by hydraulic jacks to prove the figures. The result is a superior fixture and a great reduction in the design hours required on each individual unit. Read about it in these pages soon.

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Wooden form blocks are satisfactory for stretching sheet metal, provided well-seasoned stock is used. White pine, straight-grained birch and mahogany blocks are suitable for runs up to 1,000 pieces

Selection of Stretch-Press Form Blocks

Materials used in the construction of blocks to form sheet metal in stretch presses govern the successful and economical operation of these machines. The designer must base his selection on permissible tooling costs, which increase in proportion to the number of parts to be made

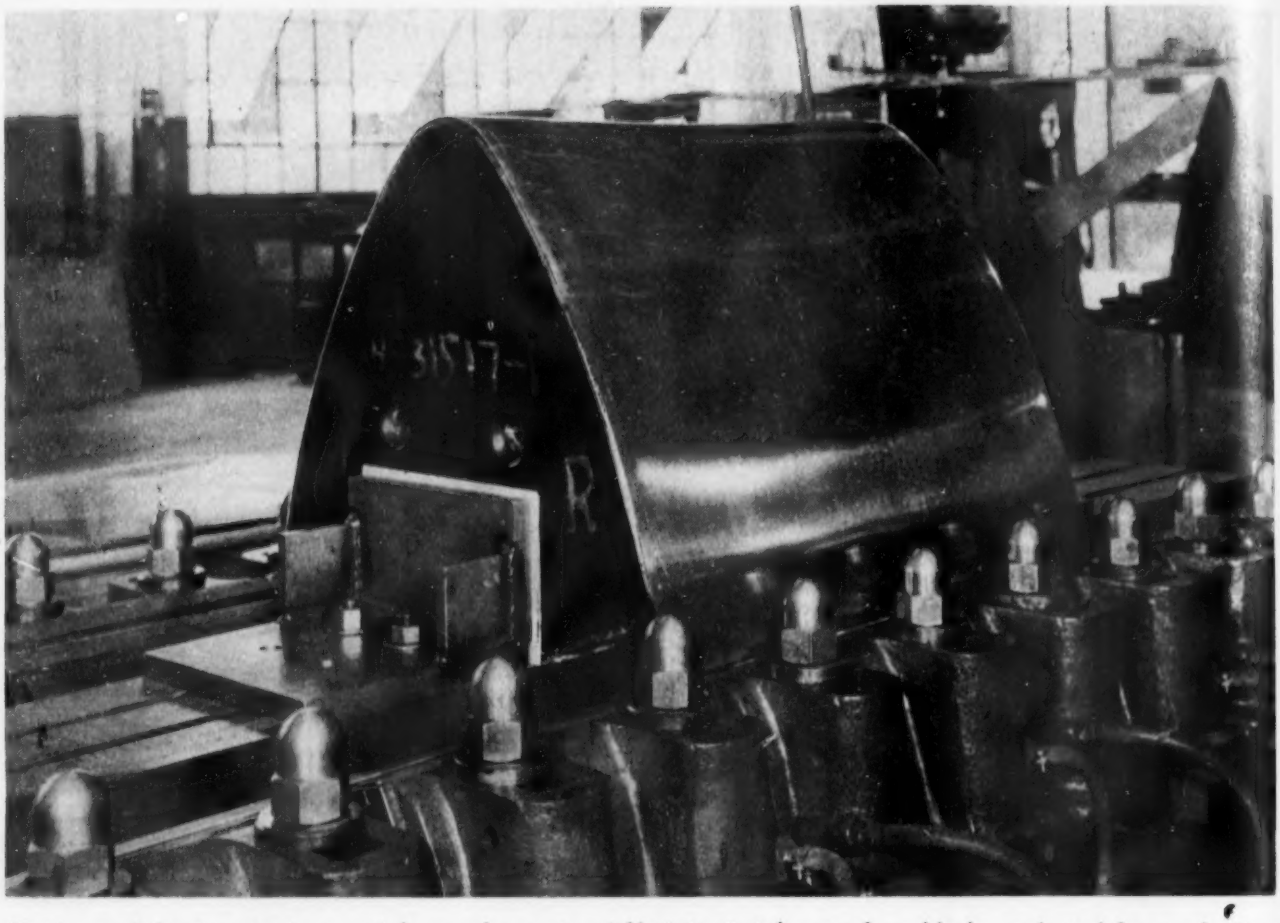
BY C. L. FENN, CHIEF TOOL ENGINEER, EDO AIRCRAFT CORP.

STRETCH-PRESS form blocks can be made of wood, cast iron, Kirksite, Masonite, or one of the cloth base phenolic resin bonded materials like Banelyte or Insurok. Concrete and cast plastics have also been used and are satisfactory within certain limitations. The major factors to be considered when choosing the proper material for a given block are (1) the quantity of parts to be formed, which is usually the primary factor, (2) configuration of the block, and (3) the strength of the form block.

The quantity of parts to be formed governs the permissible tooling cost. The quantity generally controls the choice of block material, since it is usually true that the more durable the tool, the higher the cost.

For limited production, wood is satisfactory, provided well seasoned stock is available. White pine, straight-grained birch and mahogany have been used with excellent results. In certain cases, as many as 1,000 pieces have been stretch-formed on a pine block, with occasional repairs of a minor nature.

If longer runs are necessary—up to



Plastics and low-temperature metals can be cast quickly into stretch-press form blocks, and used for production runs up to 4,000 parts. Quantity production over a long period of time warrants the use of the polished cast-iron blocks. Plastic forms, impregnated with graphite, facilitate stretching and have excellent wear-resistant properties

approximately 4,000 parts—Kirksite will stand up well, provided there are no points of extreme pressure. The inherent greasy nature of this alloy is most desirable, since it makes necessary only limited lubrication of the die surface. This promotes speed of operation. It also tends to eliminate small irregularities caused by excess lubricant piling up in one spot and preventing the sheet from "coming home" on the block. It should be borne in mind that there is a very real movement of the sheet over the form block during the stretching operation, and anything which assists in the easy flow of the metal as it is stretched is beneficial.

Cost of Form Blocks

Considerable production over a long period of time will warrant polished cast-iron blocks which are practically permanent equipment. Although cast iron does not have the "greasy" qualities of Kirksite, the coefficient of friction between it and other dissimilar metals is low, and it offers very little resistance to the flow of the sheet being stretched.

A reasonable cost for first-grade wood blocks under existing wartime conditions is from $30 to $35 per square foot of finished stretching surface. This includes the skids and cross-bracing on which the block rests, as well as any necessary ridge or edge reinforcements. Kirksite blocks are somewhat higher in cost, since it is necessary to make either wood or plaster-of-paris patterns, and the castings must be polished and finished by hand. The most expensive of the three is cast iron. This material requires about the same procedure as Kirksite, but it costs considerably more to finish and polish.

The use of Masonite is advisable only in rather "chunky" blocks which require little or no hammer work on the sheet while it is being stretched, since Masonite tends to disintegrate under impact on its edge grain. The Masonite die stock used for making form blocks has the advantage that it is practically impervious to water, and consequently changes in humidity have no effect on the size and shape of the block.

Cloth-base phenolic resin bonded substances, particularly those impregnated with graphite, are excellent from the standpoints of wear resistance, workability and constancy of contour regardless of changes in humidity. Concrete and cast plastics are good for chunky blocks of the same type for which Masonite may be profitably used. When using these materials, it is well to be sure that the blocks have ample support under their entire surface.

Configuration of the Block

Where there are sharp ridges or other shapes to be formed that result in points of very high pressure, wood laminations will wear excessively. For this reason, in constructing laminated wood form blocks, it is good practice to make the lamination at pressure ridges or points from cast iron or graphited cloth-base phenolic material. This also is true where, in order to form the sheet properly, it is necessary to put in final sharp curvatures with a rubber mallet. Continued hammering tends to break down wood laminations. Cost of inserts at pressure points is of secondary importance.

The material to be stretched and its gage or thickness—whether aluminum alloy, cold-rolled steel, alloy steel or stainless steel—has considerable influence on the selection of material from which forming blocks are to be made. It also has a governing influence on their basic design. The thickness of the material should be considered since it, together with the basic material specification, determines the load which will be exerted upon the form block during the stretching operation.

Strength of the Form Block

Wood form blocks, when made with through vertical laminations and designed so as to be adequately supported by means of cross ties and skids, will withstand the load of stretching 0.081 in. thick 24-SW aluminum alloy sheet with no trouble. In such blocks, it has been found advisable to make the minimum depth of a lamination at the ends of the block not less than 4 in. In the case of very large wood blocks 18-ft. long and 4-ft. wide, it has been necessary to place 10-in. I-beams on the table of the stretch press, one beside the other and with the 10-in. dimension vertical, extending practically the full length of the block in order to prevent distortion of the block under the heavy stretching load. If a block is allowed to deflect to a considerable extent during the stretching operation, the sheet will be formed to the shape of the deflected block. This will produce an error in the shape of the finished sheet which may render it unfit for use. The deflection of stretching blocks must be kept to an absolute minimum if an accurate product is desired.

Kirksite is not nearly so susceptible to deflection as wood, and some overhang of the table may be allowed. The ultimate tensile strength of this material is 37,000 lb. per sq. in. and its ultimate compressive strength is 62,000 lb. per sq. in. It is advisable to calculate the strength of the die in bending if the overhang is excessive—a better rule is to simply play safe and support it as in the case of wood form blocks.

Gray cast iron also is good from the standpoint of the inherent strength of the die blocks themselves. It has an ultimate tensile strength of 25,000 lb. per sq. in. and an ultimate compressive strength of 95,000 lb. per sq. in. Because of these relatively high strengths, stretch press die blocks made from cast iron may be designed after the manner of a cast iron surface plate, with a solid top and with a base ribbed for strength. In some cases Kirksite dies for stretch-press form blocks may be cast in a similar manner.

One of the characteristic plastics used in the manufacture of form blocks has an ultimate tensile strength of slightly over 1,000 lb. per sq. in. and an ultimate compressive strength of approximately 13,000 lb. per sq. in. It will be noted that this plastic resembles ordinary concrete with regard to the relationship of ultimate tensile and compressive strengths. For this reason, it is advantageous to reinforce plastic stretching blocks in the same manner as concrete—that is, to place reinforcing bars on the tension side and to rely on the compressive strength of the material to carry the bending load on the opposite side of the block.

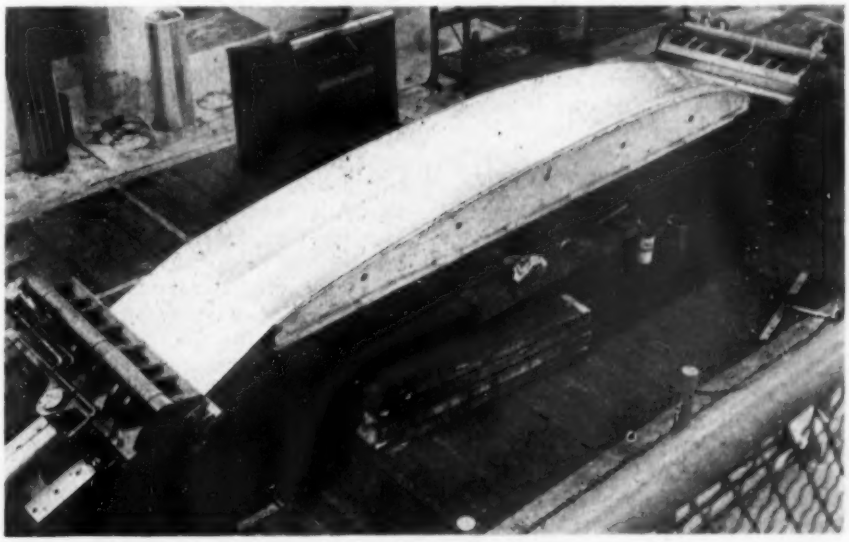
It has also been found through experience that unless the cast plastic form blocks are supported throughout their underside by a rigid structure, the lower edges will tend to chip or shear off. Consequently, special supports in the form of I-beams or subsidiary block cradles should be used. The use of expanded metal lath in the compressive flange of the block has proved satisfactory, since it has an excellent retarding action on the chipping induced by the load of the stretch press table on the lower surface of the block. It is possible to obtain a very highly polished surface with this material. This permits easy slippage of the sheet, with correspondingly good results in the stretching operation.

Construction of a Wood Block

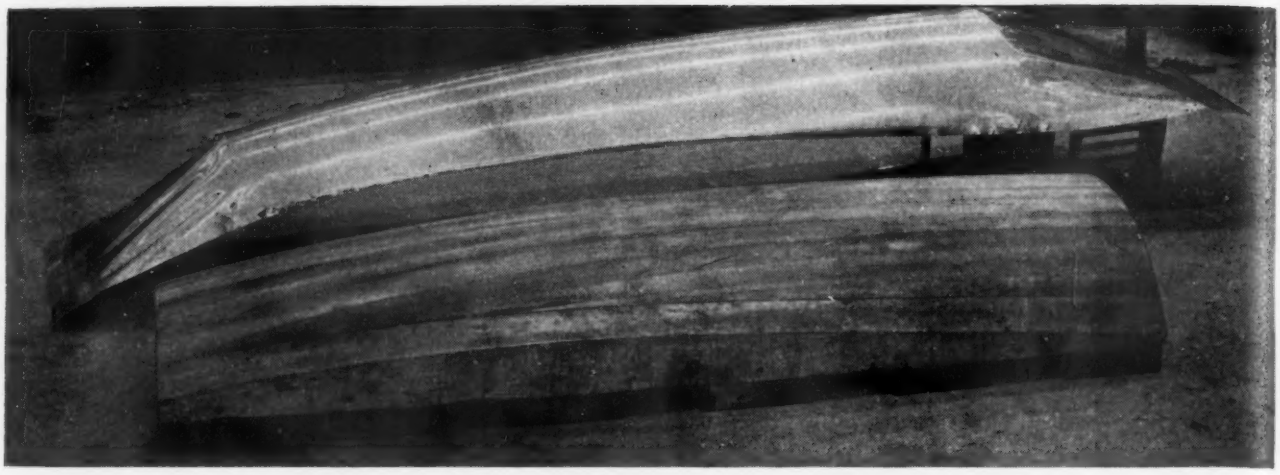
It is impossible to force a sheet being stretched to conform to a block which has a re-entrant curvature, sometimes referred to as a "pocket." The block must be designed so that a string pulled longitudinally across the block in a line duplicating the line of pull from the sheet-holding jaws will follow the block from end to end, without leaving its surface. It is good practice to laminate a wood block so that the sheet is stretched parallel to the grain of the wood. This allows the laminations to be developed to best advantage.

The following method of constructing a float forward bottom sheet form block is the one used at the plant of the Edo Aircraft Corporation in making laminated wood blocks. After the size and shape of the sheet to be stretched has been determined, master lines are laid out in the mold loft and block laminations are developed, using standard dressed lumber sizes. It is advisable to start at the longitudinal center-line of the block and work both ways, due to variations in the lumber thickness. In this way variations in the planks will have the least effect on the subsequent trimming of the block. A single templet often can be laid out in such a manner that it can be used for scribing all of the block laminations, by using it in different positions according to a table of offsets prepared by the tool engineering department.

After the laminations have been scribed and roughed out, they should be assembled in their proper order on a level surface. The position of the bolts to be put through the block then can be marked in one of the two outer planks. This plank can then be drilled, and later used as a templet to drill the others singly in a drill press. The bolts should be from ½ to 1 in. in diameter, depending on the size of the block.



High ridges in wooden form blocks are high-pressure points that wear excessively. Such ridges can be made from cast-iron or plastics impregnated with graphite, thus increasing the accuracy and the life of the blocks



Wooden form blocks should be made with through vertical laminations supported by cross-ties and skids. The minimum depth of a lamination at the ends of a block should not be less than 4 in. They should be adequately supported in the press to prevent deflection and improperly formed sheets

The laminations should then be reassembled on several of the through bolts. Considerable time can be saved in trimming the block by sawing the top edge of the laminations to the approximate angle and contour of the finished block by proceeding as follows:

With the laminations assembled, mark each plank from the adjacent smaller plank. This marking then shows directly the angle of bevel to which each plank must be cut to make it fair with its fellows. It is then a simple matter to unstack the laminations and run them through a bandsaw with an adjustable table. One or two men can feed the planks into the saw while a third man adjusts the table to the varying angular bevel required as the piece is fed through. If the angular transitions are great, it will be necessary to have a large amount of set in the teeth of the saw. When this operation is completed, the planks are ready for gluing.

Gluing Technique Is Important

The gluing operation should not exceed 40 min. Cold-water casein glue should be applied to the laminations with a whitewash brush as rapidly as possible. As the gluing progresses, the laminations should be reassembled piece by piece and the through bolts tightened after placing large washers under their heads. This squeezes the excess glue from between the laminations. Large cabinet clamps should also be applied, and the block allowed to dry for a least 24 hr.

The base should then be applied, using cross ties 2 in. or more thick on 18 in. centers. There also should be three or four 4×4 in. longitudinal skids running the full length of the block. The two outermost skids should be set even with the two outer laminations. These outer laminations should be made of hard wood, and should be counterbored or recessed at the bolt holes so that the ends of the bolts are flush. This allows the blocks to be stacked on edge to conserve floor space and give added stability when they are stacked in storage areas.

The bottom skids should be fastened carefully with cut thread lag screws set so their heads are even with the bottom surface of the skids. It is advisable to have these lag screws penetrate the main body of the block at least 3 in. All base joints should be glued to prevent the block from "working" under load and subsequently breaking down. Then all faces of the block except the working surface should be sealed with varnish to minimize moisture absorption.

When finishing the working surface of the block, it is advisable to set it up in its true position. This enables the most advantageous use of the trim templet. A datum wire should also be set up to establish a reference line, and the longitudinal sweep templet fitted to the block with the least possible amount of trimming. The transverse curves are then fitted, using a precision level on the top edge of the templets, which should be cut to a line suitable for this use. The remainder of the block is now trimmed to fair through all stations and the ends rounded to permit easy flow of the sheet under load. The surface of the block should be immediately sealed with several coats of thin shellac.

Inserts, rather than complete laminations of wear-resistant material, may be used on the high points or along the ridge of the block in order to prevent breakdowns. These inserts can be put in by rabbeting the block 2 in. deep to obtain the proper stability and necessary firm backing for the insert. A wood check piece should be fitted to match the bottom of the rabbet on one edge and cut to the contour of the block on the other. This wood insert is used as a model for the manufacture of a Micarta, Insurok or metal insert. The finished insert is driven home and fastened in the block with flat-head wood screws long enough to penetrate 2 in. in the body of the block. The screw holes in the insert should be countersunk deep enough so that at least half the depth of the screw heads remain after they have been filed flush with the surface of the block. Several coats of clear spar varnish rubbed down between coats complete the job.

Drill Grinder's Prayer

By FRANCES C. JAMROCK

I RECENTLY became a defense worker and one of the first things I was taught was to sharpen a drill. I had such difficulty in acquiring the knack that I was inspired to write this verse:

I pray the Lord my wish fulfill
And let me grind the perfect drill.
Guide this shaky hand of mine
To make both angles fifty-nine;
Let that center be dead true,
And the clearance just right, too.
This I ask and nothing more —
Grant it Lord, I do implore.

Take a Healthy Chip

BY FRANK J. WINTERSDORFF, ENGINEER, COLT'S PATENT FIRE ARMS MANUFACTURING COMPANY

The pay-off in milling is pieces per hour: cash in by making sure that chip thickness is a maximum for the material and the depth of cut

WITHOUT REALIZING IT, many methods engineers do not sufficiently extend calculations of feeds for milling to obtain a figure of real value. It is common practice to compute to a certain point—namely, the feed per tooth—and let it go at that. This term "feed per tooth" is a misnomer. It carries the sound of finality, but is correct only when the radius of the cutter equals the depth of the cut, a rather rare condition.

The actual chip produced is the important factor. It is dependent not merely on cutter diameter, number of teeth, table feed and spindle revolutions, but also on depth of the cut and is, with the exception of the above-mentioned case, never equal to the feed per tooth.

To prevent misconception, I avoid "feed per tooth" for a more appropriate term, "basic table advance per tooth." Fig. 1 demonstrates the relationship between the basic table advance per tooth and the actual chip produced at various depths of cut. This illustrates the characteristic curve, a prolate trochoid or wedge, formed by the tooth of a rotating milling cutter as the work is being fed against it.

Let us assume the table feed is set so that the work seems to advance toward the cutter at a rate of 0.008 in. per tooth. The word "seems" is used advisably. Although this figure does represent the table feed, the work never progresses at the same rate, unless the depth of the cut is equal to the radius of the cutter. Fig. 1 shows that, as the depth of the cut decreases, so does the thickness of the chip, yet the basic advance of the table per tooth remains constant.

It follows that feed per tooth is only a factor in carrying the calculations further in order to arrive at the approach of the cutter and the ultimate result, the maximum chip thickness. The maximum thickness is important because formation of a chip begins at practically nothing at the bottom of the cut and reaches its greatest thickness as the tooth leaves the work.

The approach of the cutter may be calculated by using the formula:

$$A = \sqrt{d\,(D-d)}$$

where

A = approach of the cutter
D = diameter of the cutter
d = depth of the cut

Example:

Diameter of cutter = 12
Depth of cut = 0.750

$$A = \sqrt{0.750\,(12-0.750)}$$
$$A = 2.91$$

An accompanying table lists the approaches of various diameter cutters. Those not tabulated may be calculated.

The maximum chip thickness is found as follows:

$$\text{Max. chip} = \frac{\text{Approach} \times \text{Basic Advance per Tooth}}{\text{Cutter Radius}}$$

Example:

Diameter of Cutter	5
Number of Teeth	30
Spindle Rev. per Min.	52
Surface Feet per Min.	68
Table Feed per Min.	3.4
Feed per Rev.	0.065
Basic Adv. per Tooth	0.00215
Depth of Cut	0.500

$$\text{Approach} = \sqrt{0.5\,(5-0.5)} = 1.5$$

$$\text{Max. Chip} = \frac{1.5\,(0.00215)}{2.5} = 0.00128$$

The accompanying alignment chart may be used to find the maximum chip thickness. Employing the data in the preceding example, the steps in using the chart are as follows: From point *a* on the scale "R.P.M. of Cutter" draw a line to *b* at the scale "Table Feed," intersecting the pivot line at *c*. Then from point *d*, on the scale "Number of Teeth" draw a line through *c*, intersecting the scale "Feed per Tooth" at *e*. Find the ratio *d*/*D*

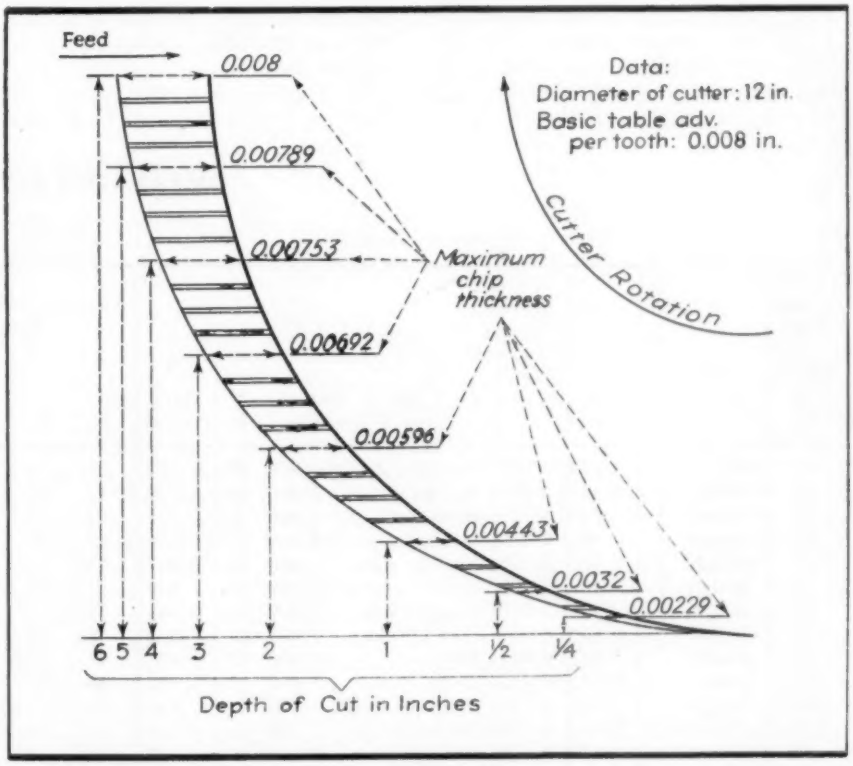


Fig. 1—Chip thickness never equals the "feed per tooth," or basic table advance per tooth, except when the depth of cut equals the cutter radius

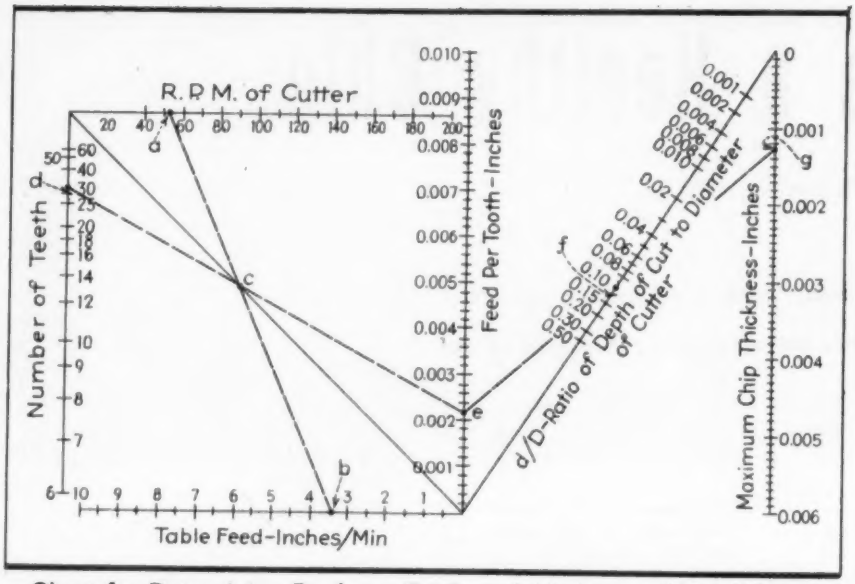


Chart for Determining Feed per Tooth and Maximum Chip Thickness

Contributed by H. P. Fullerton, Assistant Professor, University of Buffalo

(ratio of depth of cut to cutter diameter) and mark point *f* on that scale. Finally, run a line from point *e* through point *f*, intersecting the scale "Maximum Chip Thickness" at *g*, and read the value 0.00128 in.

In plants where this method is not in use, it is desirable to compile these data and to segregate them for all milling machine operations on the same material specifications. Where the feed was set merely with respect to the basic table advance per tooth, or where shop men were allowed to use their own discretion, it may be found that the maximum chip thickness will vary from 0.0002 to 0.007 in. for operations on exactly identical material.

By comparing these figures it is possible to form an opinion of the desirable chip thickness. Large cutters, coarse and staggered tooth, as well as helical cutters, can stand more feed. Trial runs will determine the chip thickness and spindle speed at which the cutter performs best. Consideration should be given to these points: (1) too light a feed will cause the cutting edges to wear quickly since they merely rub over the work, and (2) how many parts can be milled before the cutter requires resharpening?

Of course, before the speeds and feeds are checked, the methods engineer should study the sequence of operations. It is often possible to consolidate two or more successive operations on parts which require a great number of milling operations. Care must be taken in the grouping process so that cutters of small diameters work together in one operation and large diameter cutters on another operation. Otherwise, nothing is gained because the difference in approach of the large and small-cutters will increase the machining time. If the difference in diameter between cutters is great enough, it is possible to attain the correct speed for the large cutter, by using cemented-carbide tips.

How does the use of maximum chip thickness affect production? An accompanying table compares the results obtained for fifteen milling operations on a specific gun part when speeds and feeds are set by three methods: (1) in the shop by rule of thumb, (2) by the conventional time study method of considering only the feed per tooth, and (3) the suggested method of calculating the maximum chip thickness permissible with a given setup and then adjusting the spindle and table feed to approximate the ideal condition.

The story is rather accurately revealed by the sums of the machine cycle times realized under the three circumstances. These cycle totals are: (1) for rule of thumb, 39.69 min., (2) for time study procedure, 35.91 min., and (3) for methods department calculations, 19.59 min. Time study was able to reduce the shop's time by 9 percent, but the methods-

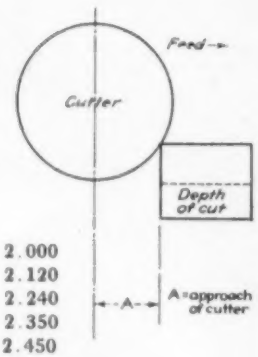
COMPARATIVE PRODUCTION RESULTS FROM SETTING

A—Rule of thumb; B—Basic table advance per tooth;

Gun Part Operation No.	Milling Operation	Handling time	Depth of cut	Cutter data: Type	Diameter	Teeth	Approach	Spindle Rev. per Min. A	B	C	Surface Ft. per Min. A	B	C	Table Feed in Inches per Min. A	B	C
45	Rough	0.90	0.625	Helical slab	4.000	10	1.450	38	72	88	40	75	92	3.400	4.000	6.800
50	Rough	0.50	2.250	Helical end	3.000	12	1.500	112	88	112	88	69	88	1.470	2.200	2.200
60	Finish	0.75	0.020	Plain mill	2.500	6	.223	200	155	155	131	102	102	2.375	3.000	4.000
65	Rough	0.60	0.250	Interl. form	6.500	24	1.250	63	49	49	107	84	84	1.375	2.500	4.000
70	Rough	0.50	1.000	Angular side	5.000	20	2.000	72	58	72	94	76	94	1.470	1.800	2.800
75	Rough	1.10	0.250	Form	3.000	18	.830	74	116	116	58	91	91	2.750	2.750	5.750
85	Rough	.50	1.000	Angular side	5.000	20	2.000	72	58	72	94	76	94	1.470	1.800	2.800
90	Finish	1.60	0.020	Plain (20°H)	4.000	10	.282	88	88	88	92	92	92	1.800	1.800	5.300
100	Finish	.82	0.062	Form	4.000	22	.490	95	95	95	99	99	99	2.500	2.500	3.400
120	Rough	1.50	0.875	Stagg. helic.	5.000	18	1.900	58	58	72	76	76	94	1.800	1.800	2.800
140	Rough	.30	0.125	Helical side	7.500	30	.950	60	45	55	118	88	108	3.125	2.500	8.875
195	Slotting	1.10	0.375	Side mills	4.000	34	1.170	74	92	92	78	96	96	2.750	2.750	4.625
35	Rough	.90	3.000	Gang	8.500	36	4.060	47	58	88	104	129	196	3.400	2.800	6.800
40	Rough	1.15	1.375	Gang	7.000	30	2.785	38	72	88	70	132	162	2.800	2.800	6.800
80	Finish	1.40	0.062	Gang	7.000	36	.658	47	47	88	86	86	162	1.800	1.800	6.800

APPROACH OF CUTTER FOR SPIRAL MILLS, KEYWAY CUTTERS AND SAWS

Diam. of Cutter	Depth of Cut, Inches											
	1/16	1/8	3/16	1/4	3/8	1/2	3/4	1	1 1/2	2	3	4
1 1/4	0.272	0.370	0.440	0.500	0.570	0.612						
1 1/2	0.299	0.410	0.490	0.560	0.650	0.710	0.750					
1 3/4	0.320	0.450	0.540	0.610	0.720	0.790	0.870					
2	0.350	0.480	0.580	0.660	0.780	0.870	0.970	1.000				
2 1/4	0.370	0.520	0.620	0.710	0.840	0.930	1.060	1.120				
2 1/2	0.390	0.540	0.660	0.750	0.890	1.000	1.150	1.220				
2 3/4	0.410	0.570	0.690	0.790	0.940	1.060	1.220	1.320				
3	0.430	0.600	0.730	0.830	0.990	1.120	1.300	1.410	1.500			
3 1/4	0.450	0.630	0.760	0.870	1.040	1.170	1.370	1.500	1.620			
3 1/2	0.460	0.650	0.790	0.910	1.080	1.220	1.440	1.580	1.730			
3 3/4	0.480	0.670	0.820	0.930	1.130	1.280	1.500	1.660	1.840			
4	0.490	0.700	0.850	0.970	1.170	1.320	1.560	1.730	1.940	2.000		
4 1/4	0.511	0.720	0.870	1.000	1.210	1.370	1.620	1.800	2.030	2.120		
4 1/2	0.530	0.740	0.900	1.030	1.240	1.410	1.670	1.870	2.120	2.240		
4 3/4	0.540	0.760	0.920	1.060	1.280	1.460	1.730	1.930	2.210	2.350		
5	0.560	0.780	0.950	1.090	1.320	1.500	1.790	2.000	2.290	2.450		
5 1/2	0.580	0.820	1.000	1.140	1.390	1.580	1.890	2.120	2.450	2.640		
6	0.610	0.860	1.040	1.200	1.450	1.660	1.980	2.240	2.600	2.830	3.000	
6 1/2	0.634	0.890	1.090	1.250	1.510	1.730	2.080	2.350	2.740	3.000	3.240	
7	0.658	0.930	1.130	1.300	1.580	1.800	2.170	2.450	2.870	3.160	3.460	
7 1/2	0.680	0.950	1.170	1.350	1.630	1.870	2.250	2.550	3.000	3.220	3.670	
8	0.710	0.990	1.210	1.390	1.690	1.940	2.330	2.650	3.120	3.460	3.870	4.000
8 1/2	0.730	1.030	1.250	1.440	1.740	2.000	2.410	2.740	3.240	3.610	4.060	4.240
9	0.750	1.050	1.280	1.480	1.800	2.060	2.490	2.830	3.360	3.740	4.240	4.470
9 1/2	0.770	1.080	1.320	1.520	1.850	2.120	2.560	2.920	3.470	3.880	4.420	4.690
10	0.790	1.110	1.350	1.560	1.900	2.180	2.630	3.000	3.570	4.000	4.580	4.900
10 1/2	0.810	1.140	1.390	1.600	1.950	2.240	2.710	3.080	3.670	4.120	4.750	5.100
11	0.830	1.170	1.420	1.640	2.000	2.290	2.770	3.160	3.770	4.290	4.840	5.290
11 1/2	0.850	1.190	1.460	1.680	2.040	2.340	2.840	3.240	3.870	4.360	5.040	5.480
12	0.860	1.220	1.490	1.720	2.090	2.400	2.910	3.320	3.970	4.470	5.190	5.650



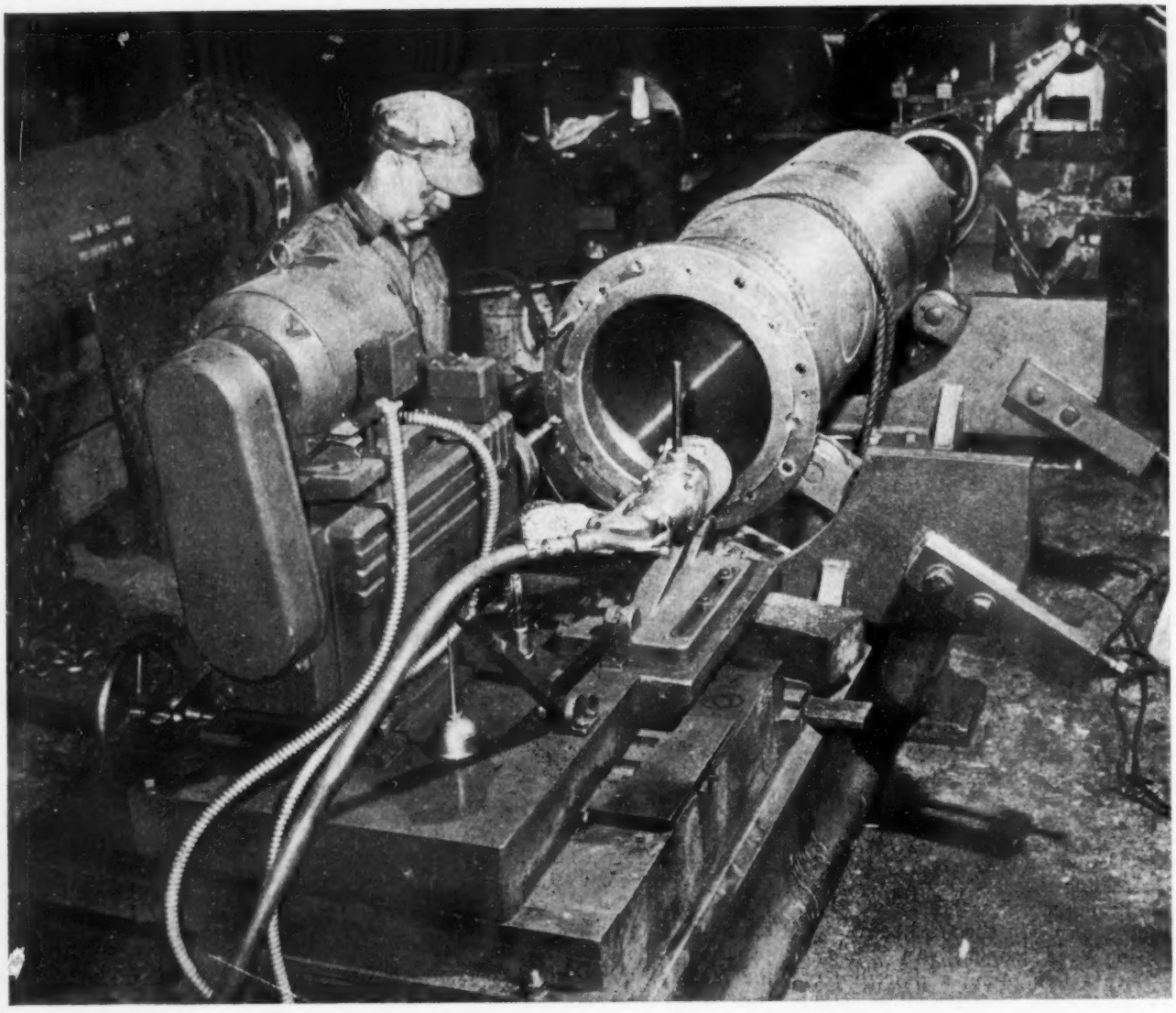
engineering study of this part reduced the milling time by 50 percent.

The improvement can be stated in another way. The shop had been using cutting speeds ranging from 40 to 131 surface ft. per min., a difference of 91 ft. Time study reduced the spread to 63 surface ft. per min. by specifying cutting speeds from 69 to 132 surface ft. per min. But by calculating the maximum chip thickness and then adjusting spindle speed and table feed, the methods engineering department boosted the minimum cutting speed to 84 surface feet per min. on the first 12 operations, and narrowed the spread to 18 surface ft. per min. In some cases, the feeds were more than doubled by the methods-engineering department, but the chip thickness remained within acceptable limits.

MILLING SPEEDS AND FEEDS BY THREE METHODS:

C—Maximum chip thickness

Table Feed, Inches per Revolution			Basic Table Advance, Inches per Tooth			Max. Chip thickn. in Inches per Tooth			Cycle Time, Minutes per Piece						Production per Hour		
									Machine Time only			Total Time (Mach. + Handl.)					
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
.0895	.0565	.0773	.0089	.0047	.0077	.0065	.0034	.0056	2.59	2.20	1.29	3.49	3.10	2.19	17.19	19.35	27.39
.0138	.0250	.0196	.0011	.0021	.0016	.0011	.0021	.0016	2.74	1.83	1.83	3.24	2.33	2.33	18.51	25.75	25.75
.0137	.0193	.0258	.0023	.0032	.0043	.0004	.0006	.0008	3.35	3.07	2.30	4.10	3.82	3.05	14.63	15.70	19.67
.0218	.0510	.0815	.0009	.0021	.0034	.0003	.0008	.0013	3.82	2.10	1.32	4.42	2.70	1.92	13.57	22.22	31.25
.0204	.0311	.0389	.0010	.0015	.0019	.0008	.0012	.0015	3.45	2.82	1.81	3.95	3.32	2.31	15.18	18.07	25.97
.0372	.0237	.0495	.0026	.0013	.0027	.0011	.0007	.0015	1.00	1.00	.48	2.10	2.10	1.58	28.57	28.57	37.90
.0204	.0310	.0390	.0010	.0015	.0019	.0008	.0012	.0015	3.45	2.82	1.81	3.95	3.32	2.31	15.18	18.07	25.97
.0204	.0204	.0600	.0020	.0020	.0060	.0003	.0003	.0008	4.12	4.12	1.40	5.72	5.72	3.00	10.49	10.49	20.00
.0263	.0263	.0358	.0020	.0020	.0016	.0003	.0003	.0004	.80	.80	.54	1.62	1.62	1.36	37.00	37.00	44.10
.0310	.0310	.0389	.0017	.0017	.0021	.0013	.0013	.0016	4.45	4.45	2.86	5.95	5.95	4.36	10.08	10.08	13.70
.0520	.0556	.1610	.0017	.0018	.0054	.0004	.0004	.0013	.85	1.06	.30	1.15	1.36	.60	52.20	44.10	100.00
.0372	.0299	.0503	.0011	.0008	.0015	.0006	.0005	.0008	1.12	1.12	.67	2.22	2.22	1.77	27.04	27.04	33.90
.0720	.0483	.0772	.0020	.0013	.0021	.0019	.0012	.0019	2.63	3.20	1.32	3.53	4.10	2.22	16.99	14.63	27.04
.0738	.0390	.0772	.0024	.0013	.0025	.0019	.0010	.0020	2.32	2.32	.96	3.47	3.47	2.11	17.29	17.29	28.43
.0383	.0383	.0772	.0010	.0010	.0021	.0002	.0002	.0004	3.00	3.00	.80	4.40	4.40	2.20	13.63	13.63	27.27



Drill Head for Stern Tubes

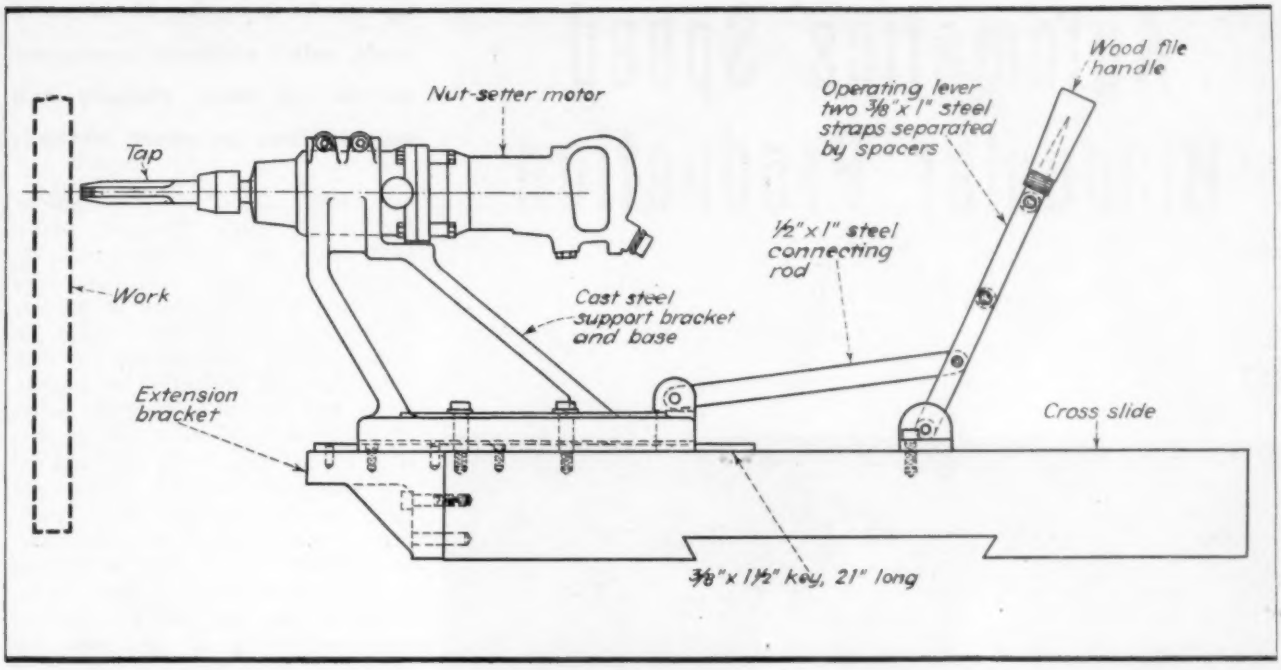
BY C. A. BLOOM AND MERL HARKLESS, DODGE MANUFACTURING COMPANY

WHEN the Dodge Manufacturing Company contracted to make a number of stern-tube liners. As a result a drilling of the large horizontal boring mills in the shop were loaded to capacity. This being the case, these machines could not be used for drilling and tapping the flange bolt holes in the ends of both the stern tubes and the bronze stern tubes for Liberty freighters, all and tapping machine was designed and built especially for this work.

A standard No. 25-A Ex-Cell-O drilling head with hydraulic feed was mounted on a cast-iron cross-slide fitted to a cast-iron base. This assembly was then bolted to the ways on the tailstock end of a 40 in. swing Gleason shafting lathe having an extra long bed. The cross-slide is adjusted by a handwheel and leadscrew fitted in the base casting. This construction still permitted the lathe to be used for normal turning operations on short lengths of shafting and for a number of turning operations on the stern tubes.

When set up for drilling and tapping, the stern tube is held by two steadyrests which can be adjusted until the tube is in a horizontal position with the flange end adjacent to the drilling unit. The steadyrests are made of welded plates braced with short gussets and bolted to the bed of the lathe. Rollers that bear against the tube are fitted to sliding shoes which are adjusted by threaded rods screwed into the steadyrest brackets.

A cast-iron plate-type drill jig fits on the end of the stern tube and locates the two rows of flange holes to



When boring mills were not available for drilling and tapping stern-tube flanges, a standard Ex-Cell-O drilling unit and an Ingersoll-Rand air motor were mounted on the tailstock end of a Gleason shafting lathe to perform these operations. The drill and tap are lined up at the flange face by rotating the tube on rollers fitted to all-welded steadyrests that are reinforced with gusset plates and bolted to the lathe bed

be drilled. Once the jig plate has been positioned, the drill is aligned with one of the jig bushings by adjusting the cross-slide. The cross-slide is clamped in this position. After the first hole has been drilled in a given bolt circle, the operator rotates the stern tube to bring the next drill bushing in front of the drill.

There are two bolt circles to be drilled, each having eight holes. The outer circle has clearance holes for 1 in. bolts, while the inner circle is drilled with 7/8 in. diameter holes which are later tapped with 1 in. eight pitch National Coarse threads. The spindle of the drilling unit is rotated at 300 r.p.m. for both size drills which are fed hydraulically into the flange.

The original design of this drilling unit made no provision for tapping the holes, since hand tapping was contemplated. However, after the unit had been in use but a short time, it was decided that the operation could be improved materially by providing a power unit to drive the tap, the design of which is shown in the drawing. It is comprised of a No. 534 Ingersoll-Rand nut-setter motor held in a horizontal position by a cast bracket made integral with a slidable base. This base is guided on top of the cross-slide by a long flat key bolted to the cross-slide castings. Longitudinal feed of the slide is effected by a hand lever connected to the base by a steel link.

Tapping is done after all the flange holes have been drilled, and the jig plate has been removed from the end of the stern tube. The holes in the flange are aligned with the spindle of the tapping unit in the same manner as they were brought in line with the drill during the first part of the operation. The air motor is fitted with a square driver and the tap is held in a standard chuck which fits over the driver, thus keeping the tap central.

RADIUS IMPROVES THREADING OPERATIONS

BY GROVER C. MASTERS, THOMAS A. EDISON INDUSTRIES

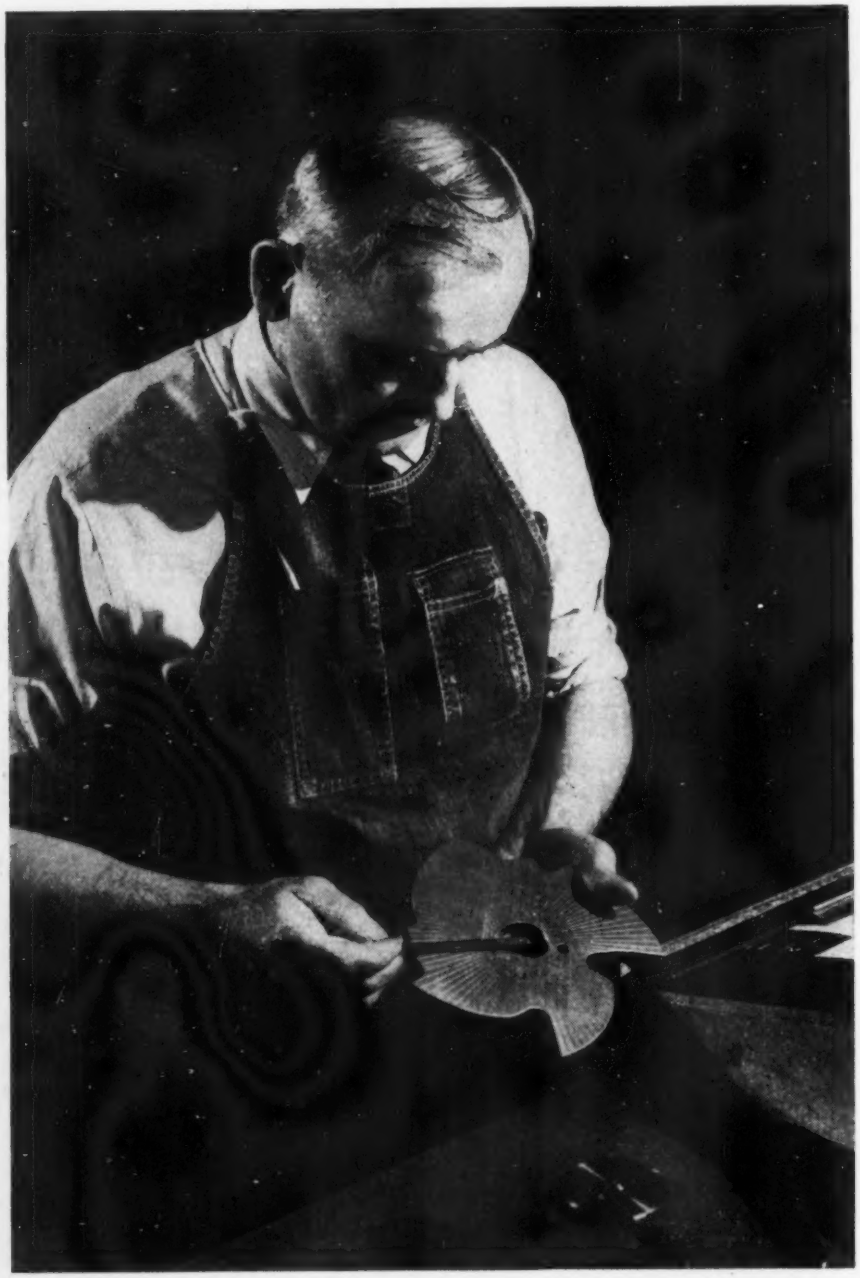
COMMON PRACTICE calls for turning or boring a 45 or 60 deg. chamfer at the start of a threaded section, whether internal or external, in order to permit starting threading tool more efficiently and to reduce burrs at the start of the thread. Experience in producing close-tolerance threads of a wide range of diameters and pitches has shown that the substitution of a radius for the chamfer at the start of the thread, and at the end of the threaded section where an undercut is required, has a number of advantages. First of all, burrs at the start and end of the thread are practically eliminated, those left being very fine and capable of being removed with a fine wire brush. In addition, better tool life is experienced, and one-quarter to three-quarter of full thread is obtained than when a chamfer is used.

This practice has been tried out on a wide range of ferrous and nonferrous alloys, including aluminum, brass, wrought iron and steel, and our experience has shown that the above advantages hold true no matter what the material may be. While these advantages are most noticeable when tapping or chasing the thread, they are also obtained when hobbing the threads. Size of the radius is not critical. When tapping or chasing it should be about equal to three times the depth of the thread; when hobbing use a radius equal to three times the thread depth and add about 0.010 in. to the value obtained with this formula.

Automatics Speed Binocular Production

BY JOSEPH WITCHEY, TOOL ENGINEER
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

By careful designing of cams and tools, small aluminum parts are turned out more cheaply and quickly than by other methods



Mr. Witchey checks a cam he designed for an automatic screw machine that produces aluminum parts for Army binoculars. Each hour, the machine turns out 60 pieces whose dimensions are held to 0.0007 in. on 23 operations

ASSEMBLY LINES at the Westinghouse Electric Appliance Division, Mansfield, Ohio, that had been producing refrigerators, ranges and irons were converted to manufacture of military binoculars. A complete change in manufacturing technique was required.

In planning production of binoculars it was decided to make the scores of precision metal parts that go into them on automatic screw machines fed with aluminum bar stock. Before any parts can be produced on an automatic screw machine, each movement or operation desired must be planned by the tool engineer. In order to accomplish this, we follow a definite course of listing all operations and movements on a cam and tool design sheet.

The points stressed in making such binocular parts as eyepiece cells and adapters are accuracy of dimensions, good finish and concentricity of all turned, bored and threaded sections. To make the eyepiece cell, we feed to the swing stop. Clearance is allowed for the $\frac{5}{8}$-in. roughing drill that follows. The form cutter on the front slide is brought in with the roughing drill to turn the body dimensions to within 0.010 in. of the finished size. This allows the operator to adjust the tool to the proper size for the thread roll which is carried on the back slide.

The vertical slide is brought in at this time and makes a partial cut-off to the root of the thread. This also provides clearance at the side of the thread roll. A cutter is indexed to finish-bore one inside dimension and rough-bore two other dimensions and form an angle. When this cutter enters the work far enough to make a good support, the thread roll is brought in from the back to roll the thread and move away before the dual bore cutter advances far enough to weaken the wall.

Next, the recess is cut for the tap. After this we finish-bore the inside dimensions and bore for the tap. The boring bar is held in a standard floating holder and carries three adjustable toolbits, and one toolbit is clamped on the side to chamfer for the thread.

The next operation is tapping Proper tap alignment is always a problem on a job like this, so the special tap holder provided combines the pull-out of the standard tap holder with the concentric adjustable feature of

the standard floating holder. This combination has helped considerably in producing clean-cut threads to Class 2 fit.

The next operation is to finish-turn the outside dimensions. Swing tools are used for this operation because it is necessary to drop in back of the shoulder. A second cutter was put on the standard swing tool at the proper place to turn the front dimension. The swing tool and the recess are both controlled from the back slide for the reason that the back-guided swing tool can easily be arranged to carry the second cutter required.

This arrangement also leaves the operator free to adjust the front slide as the form tool wears, without throwing the swing-turned dimensions out of tolerance. As the swing tool completes the turning operation and reaches the dwell point, the vertical slide is brought in to cut the piece off.

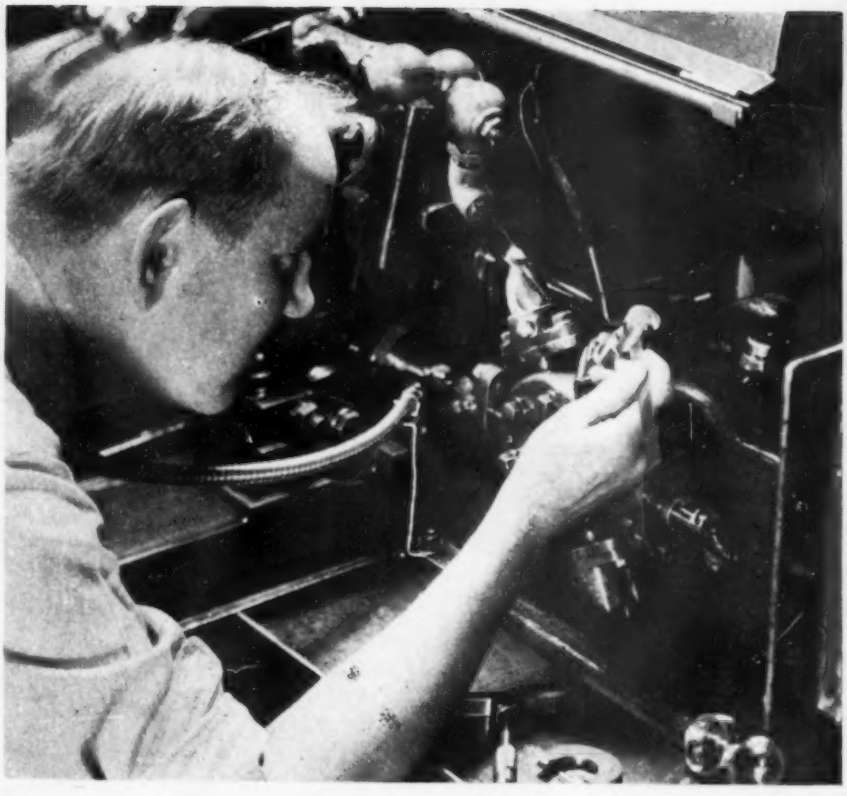
By this method, cams and tools control over 20 dimensions of one binocular part and leave only one machining operation to be performed. After the part is carefully inspected it is anodized and brought back to the machine department where the body diameter is finish-turned and the sextuple adjusting thread is chased on a small lathe, ready to be fitted to its mating part.

To produce eyecell adapters, we follow the same procedure of listing each operation desired and each movement required to perform these operations. The first operation is rough drilling. Forming from the front slide is overlapped with rough drilling. The thread roll from the back slide closely follows the form and performs its operation while the wall is still strong and the roughing drill takes part of the thrust. The thread roll is operated on the high-spindle speed, because it is not convenient to bring it in on a low speed.

Button Die Placed in Special Holder

In the next operation the front end is threaded with a button die, a special holder with float being provided to allow careful alignment. The next operation employs a rough boring cutter that bring both inside dimensions to within 0.010 of finished size. In the succeeding step we recess-bore the under-cut and then swing turn the outside dimension. In the center of the swing tool we clamp a cutter holder to chamfer the inside bore.

The last operation is to finish-bore the inside dimensions. A stub boring bar is used with two adjustable cutters. The bar is held in a standard floating holder. There was some tendency for this piece to stretch out as the wall is thinned down by turning and boring, so a facing cutter is clamped to the boring bar and the length is held as required. A seal groove is cut in back of one shoulder in a second operation. The part is then inspected, anodized and the sextuple thread is chased on the inside.



Bugs in the set-up are much less frequent by organizing tool design from a listing of all operations and movements on a cam and tool design sheet. Here a multi-bit boring tool is being checked before releasing the set-up for a production run on an aluminum binocular part

The threading operation is done on a bench lathe with thread chasing attachment. The two parts are fitted closely together and then carefully lapped to each other. By using care in chucking these parts to chase the sextuple adjusting thread, we are securing a degree of concentricity that would be difficult to obtain in any other way.

A hinge bushing for binoculars is made of brass. It is a part that looks easy to make but requires extreme accuracy in some dimensions. The narrow thread close to the shoulder is rolled from the vertical slide.

Another part is the eccentric ring which is made in an automatic screw machine with 1½ in. spindle capacity. The part is rough drilled and formed, then finish-turned on the outside with a special oversize swing tool. The spindle is stopped with the standard brake and the part is bored by a specially designed boring tool. This tool is driven by the standard turret drilling attachment. The swing tool and the eccentric boring tool carry cutters tipped with tungsten carbide which give a nice finish to either aluminum or zinc alloy.

The outside dimension is checked by ring gages with a tolerance of 0.005. The inside is held to plug gages with total tolerance of 0.0007 in. It was originally planned to recess this piece to the depth of its eccentricity and then finish the cut-off from the outside. Actual practice proved this was not necessary so the cam was remodeled and the recess time was given to the boring tool. The operator burrs the cut-off side of this ring with an emery-coated plug driven by a small motor and the part is ready for the slotting operation, which may eventually be done on the screw machine.

Here again we believe the automatic screw machine has given us a part cheaper and better than we could produce it in other ways. The automatics, of course, require careful designing of cams and tools to realize the most out of them. They also require highly skilled and trained operators.

Electronic Aid for Industry

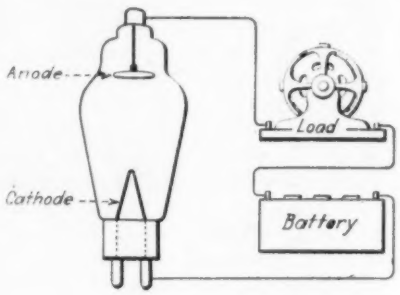
Binoculars must be protected during their manufacture from dust, lint and other air-borne particles. An electronic cleaner removes particles as small as 1/250,000 in. from the air of instrument plants, such as this

Electronics can do a lot of things for industry—but not everything. An understanding of the basic functions of electronic tubes will dispel the mystery from the subject and aid in new applications

INDUSTRY has already had a sample of what electronics can do for it. The success of induction heating, invisible machine guards and other applications have been sufficient to arouse speculation as to the extent of wide postwar uses of this modern branch of electrical science.

Broadly speaking, electronics is the science of the electron; hence it includes all electric phenomena. But usually the term refers specifically to the varied uses of the electronic tube.

Electronic hook-ups are so different from ordinary electrical circuits, and their results are so astounding, that the majority of shop men are likely to regard them as something beyond their grasp and to shy away from an understanding of their principles. Actually there is nothing baffling about the application of electronics to industrial use. Some of the confusion is caused by the fact that the tubes are used in many different ways. A brief outline of the various functions of electronic tubes may help to clarify the subject.

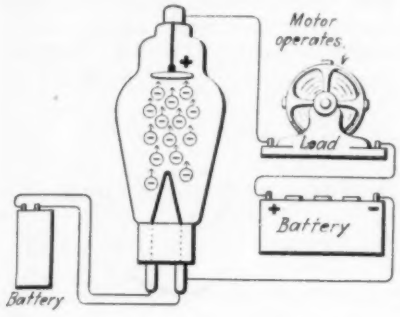


Take a simple form of electronic tube as an example. A two-element type, known as a diode, resembles an ordinary single-pole switch that can connect, for instance, a battery to its motor. In the hookup illustrated one power lead goes to the anode, the other to the cathode. The anode and cathode correspond to the contacts or poles of the switch. When the "switch" is open, the contacts are insulated from each other by a vacuum or by an inert gas inserted into the evacuated tube.

To close this switch electronically, the cathode is heated, and the anode is given a positive potential. Then negatively charged electrons, emitted from the surface of the heated cathode, fly at tremendous speed to the anode. In this way a current-carrying path is formed which closes the electronic switch and permits the motor to oper-

ate. Note that the direction of electron flow is contrary to the orthodox concept of current flow from plus to minus.

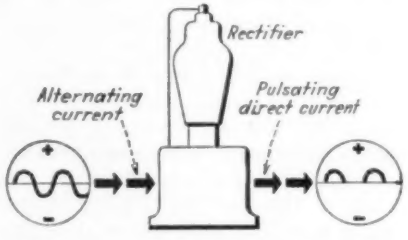
There are six basic things that this new kind of a switch can do. In the



first place, it can rectify current, converting a.c. to d.c. This is done merely by connecting an electronic tube in series with an a.c. circuit. A study of the diagrams shows that only each positive half-wave of a.c. voltage produces a current. When the anode is negative, the electrons are repelled and no current flows. In other words, because only the cathode can emit electrons, the tube amounts to a one-way street.

The result of the tube's rectifying action can be visualized with the aid of two oscilloscopes. As shown in the diagram the one at the left shows alternating current coming in, while the one on the right shows pulsating direct current going out.

This principle is used in power rectification as, for instance, in changing a.c. to d.c. on the nation's electrified transportation systems. In steel mills electronic equipment is furnishing d.c. power to drive variable-speed motors

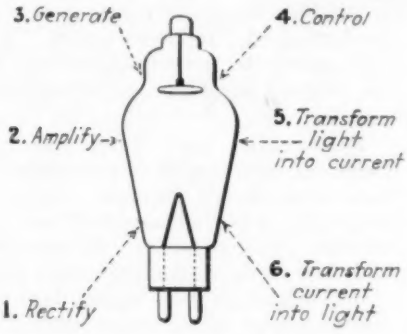


which control the operation of giant ladles and steel conveyors.

Current rectification for electroplating operations of all kinds is being handled by electronic equipment, operations possible only with direct current. It is also helping to build air power by making available record-breaking quantities of aluminum for plane construction. Before pure aluminum can be extracted from bauxite ore, direct current must be applied to the vital reduction process.

Magnesium from sea water is another achievement of industry under the stress of war. Electronic tubes furnish a reliable source of d.c. power required for this extraction process.

Still another example of electronic rectification at work is a device for cleaning air electrostatically. The precipitation of dirt and dust particles, fumes and smoke has a vital place in film processing laboratories, precision instrument factories and arsenals. In



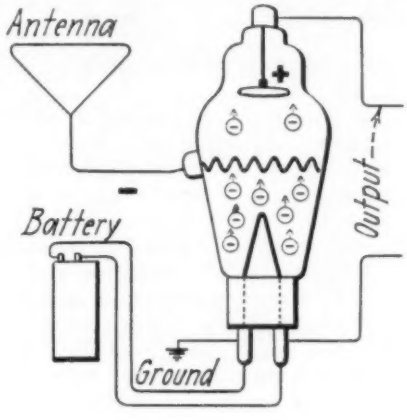
the machine shop this device has removed as much as four gallons of oil a day from the air surrounding a high-speed lathe which otherwise would settle on the lights, walls and equipment.

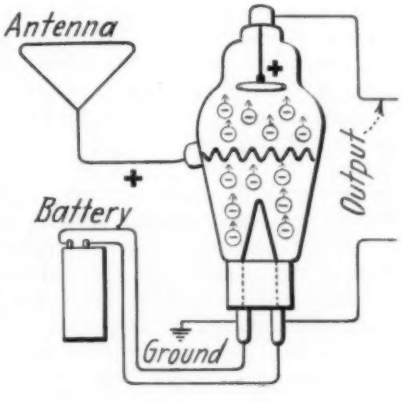
The second basic thing that the electronic tube will do is to amplify. Between the cathode and the anode of the two-element tube, a grid is placed, forming a triode. To this grid is connected an input of weak voltage, which it is wished to amplify, perhaps that of a faint radio signal from halfway around the world. Every time a negative potential is impressed on the grid, even though it be minute, it has a large effect in reducing the number of negatively charged electrons, which would otherwise keep flying from cathode to anode. Conversely, when the grid is positive, an equally large effect is exerted in increasing the flow of electrons from cathode to anode.

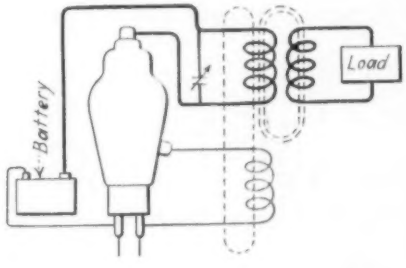
Thus a small amount of power applied at the grid is amplified into a large amount of power in the anode or work circuit. This amplifying property of the three-element electronic tube is put to work in innumerable ways. It provides radio and radio telephone contacts between airplanes and control stations on the ground; between ships and their communication bases afloat and ashore; between signal corpsmen on the firing line and field headquarters; between individual tanks and their force commanders.

In the field of engineering, electronic amplification permits the measurement and analysis of minute impulses, stepping them up to the point where they can be seen and interpreted on oscilloscopes. Dynetric balancing, made possible by electronic amplification, is used on airplane crankshafts, tiny motors or huge gears. Testing propellers for vibration is also facilitated by electronic amplifying tubes.

A third thing for the electronic tube can do is generate. The term "generate" in this connection is meant in a general rather than a technical sense. A triode, connected for oscillation as shown in the diagram, makes the sys-







tem capable of changing d.c. into a.c.

The direct current is amplified in the usual way and then it is fed back to the grid part of the amplifying voltage. Continued repetition of this feedback results in an alternating current.

The importance of this means of generating alternating current lies in the fact that it can produce high frequencies, frequencies up to millions of cycles, far beyond the range of ordinary rotating equipment.

One of the familiar applications of electronic high-frequency generation is, of course, the radio transmitter.

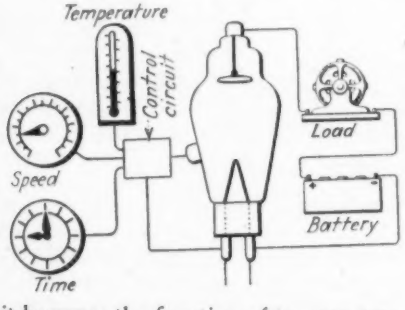
A less familiar use is high-frequency

heating at 200,000 cycles a second for "flowing" tin as the final step in the electrolytic plating of steel strip. This development makes electrolytic tin plating possible at a rate approaching a thousand feet per minute. It also saves two-thirds of the tin required by previous methods.

Other applications in the heating of metals have made possible faster and more uniform heat-treating, annealing, brazing, welding, soldering and tempering. In some processes the time cycle has been reduced to as little as five seconds. It is possible by the proper choice of frequency and equipment to harden the surfaces of mechanical parts such as gears and shafts, leaving the base metal tough and malleable.

Non-metallic materials are also heated electronically. Some of the present applications are the bonding of plywood, and the heating and curing of plastic materials. Dielectric heating is useful where thick sections of plywood, thermoplastic, or thermosetting materials are involved. The development of thermosetting bonding material now permits fabrication of thick sections of plywood in the matter of three to five minutes. Hours were required with steam or other external sources of heat. The same is true in heating and curing plastics. In addition to speed, the electronic method does a more uniform job.

Another function in the basic operation of electronic tubes is control. Here the grid is used not to amplify a weak signal, but to control the flow of power to a machine. To do this the control circuit is connected in such a way that

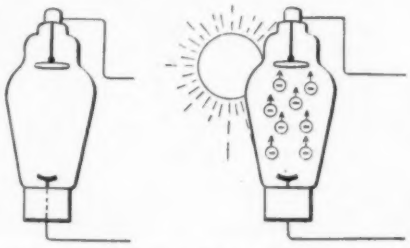


it becomes the function of temperature, speed, time or some other variable. As a result, grid potential is varied, and the work circuit is automatically closed, opened or modified.

Resisting-welding timer units are now controlled by electronic tubes. As new techniques in welding procedures are established, welding control and sequence timers play an increasingly important part in these operations. Without sound, friction or flames such controls can make and break contact with split-second timing. As a result airplane parts today are being literally sewn together with electric current.

Automatic, stepless regulation of motor speeds is another application. An electronic device permits the operations of d.c. motors from an a.c. power source. The speed is controlled with precision from a remote push-button station that permits the operator to maintain instant control at all times. In machine shops this means increased production and improved quality. The application has great possibilities in the printing, steel, and paper mill industries.

Still another basic thing that the electronic tube can do is to transform light into electric current. The ordinary heat-activated cathode of a two-element electronic tube is replaced with one made of photo-sensitive material. Light can now replace heat as the stimulator of electronic emission. The stronger the light the greater the electronic emission, and consequently, with the aid of an amplifier, the more power flows through the work circuit. This means that photoelectric tubes can function as light relays and so be



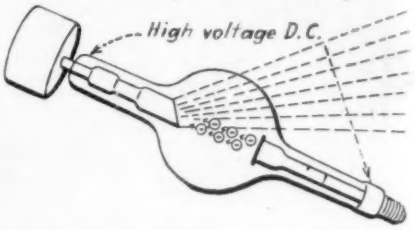
given an almost infinite variety of jobs to do.

Television is one application of this principle. Another application is an electronic eye which spots pinholes in metal strip as it comes from the rolls, automatically operating a relay that marks defective sections for rejection. Another is a safety device for workers on hazardous machines such as punch presses and shears. The electronic eye can also count passing articles faster than the human eye can see them.

Besides converting light into an electric current, the electronic tube can also convert electric current into light. The cathode ray tube is an application of this property. Through the aid of this tube an electron beam can recreate an original image on the screen of a television receiving set.

The X-ray tube indirectly transforms electric current into light images. A high potential, ranging up to 300,000 volts or more, is applied between the anode and the cathode. Electrons are emitted by a focusing cathode. Because of the extremely high voltage the electrons hit the anode with tremendous impact and cause the emission of waves, called X-rays, of exceptionally high frequency. High-frequency waves do three useful things: penetrate, excite fluorescence and affect photographic plates.

Industrial X-ray today detects porosities and fissures in welded metal seams, examines heavy castings for invisible internal weaknesses, and checks the soundness of vital parts for air-



planes. It is also applied to the inspection of armor plate.

Electronic conversion of current into light is the basis of the whole field of modern fluorescent lighting. Such lights produce more than twice the number of lumens per watt than filament incandescent lamps. Hence they are being used in increasing quantities in factories. A slight variation of the same principle results in a source of ultra-violet radiation that has the property of destroying many types of bacteria.

Radar is the electronic development that helped save Britain during the German air blitz, locating enemy planes in darkness or fog. Many developments of transportation are foreseen when the demand for military equipment has passed. Planes will fly in greater safety, ocean liners will dock at their berths without delay even though the harbor is shrouded in fog. Location of every mountain, boat or rock within the danger area will be instantly known to the controlling personnel.

These are but a few of the uses of the electronic tube. Remember that its basic functions are to rectify, amplify, generate, control, transform light into current and transform current into light. Though the applications of these basic functions excite the imagination, an effort should be made to avoid misapplication. Electronics can produce wonderful results, but it is not a universal palliative for all our troubles. Many applications are not economical or practical. When using electronics one should guard against being swept off his feet because of its popularity. Every application should be appraised on its merit and compared with time-tried mechanical methods.

Based in part on a new motion picture "Electronics at Work" produced for Westinghouse Electric & Manufacturing Co.

Steps for Cleaning Aluminum Alloys

BY C. W. SMITH
RESEARCH ENGINEER, ALKALI DIVISION
DETROIT REX PRODUCTS COMPANY

PROCESSING LAYOUTS FOR METAL CLEANING—II

Removal of surface contamination and oxides is essential before paint-bond treatments or prior to spot welding of parts

THOROUGH CLEANING of aluminum is essential before the application of chemical surface treatments designed to improve the corrosion resistance, appearance or the paint bond. The same requirement must also be observed before spot welding.

The problem of removing surface contamination from aluminum prior to anodizing, Alzac, dyeing, Alrok, or chromic-acid dip processes, or spot welding, is more severe than with cleaning operations used between intermediate steps in fabrication. For the latter, any of the three types of cleaning outlined previously—solvent degreasing, mechanical washing, or alkali tank cleaning—can be used, with the choice depending upon plant conditions and personal preference. But for cleaning as a preliminary to final finishing, it is essential to obtain a chemically clean surface which is obtained by two stages: (1) either solvent degreasing or alkali pre-cleaning, and (2) alkali tank cleaning. The relative concentrations of alkali and time for processing are: for alkali pre-cleaning, 4-6 oz. per gallon for 3-10 min., and for final cleaning, 4-6 oz. per gal. for 3-10 min.

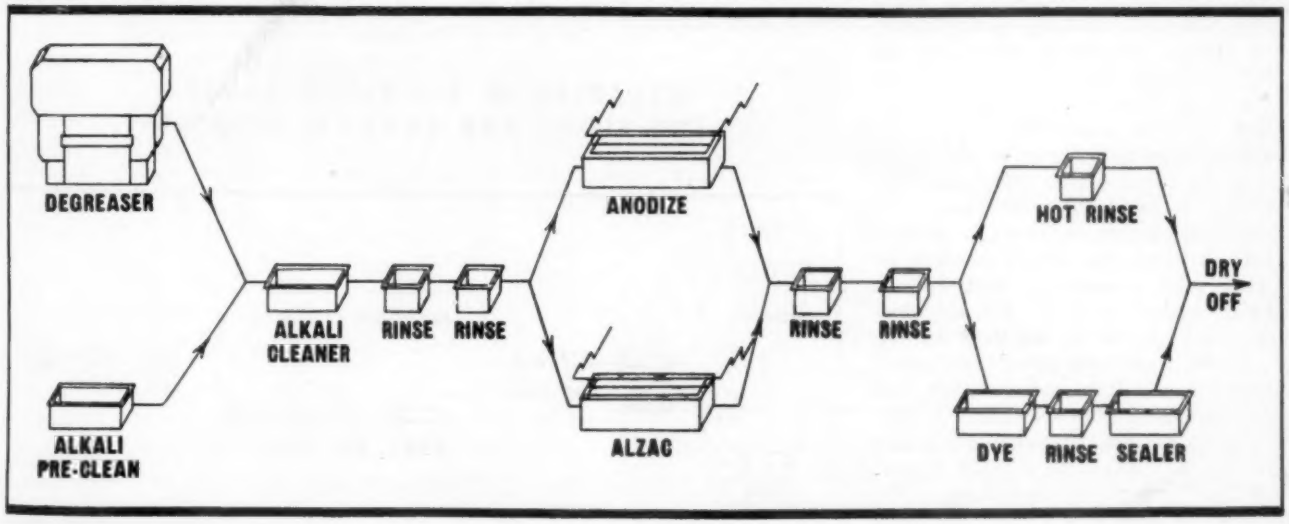
The concentration of alkali (aluminum) cleaner used in the primary tank cleaning operation and the secondary tank cleaning operation may be identical and the cleaning material the same in each tank. The primary cleaning tank is sometimes installed where large amounts of oil are removed. An arrangement of this sort prevents excessive oil floating on the surface of the final cleaning tank, which may deposit oil on the cleaned aluminum parts before rinsing. The two-tank system does a more complete job where a preliminary cleaning operation using solvent degreasing is not present. The time of cleaning in either alkali tank is dependent upon the amount of oil present and the ease in removal. Usually, if the primary cleaning step runs the maximum time, the secondary cleaning step will require the minimum amount of time given or less.

Aluminum goods reach the final cleaning operation with these types of surface contamination: (1) a straight mineral oil, or (2) tripoli type buffing compounds (used on ornamental goods), which usually contain high-melting point waxes and stearic acid. The latter is difficult to remove from recesses or holes.

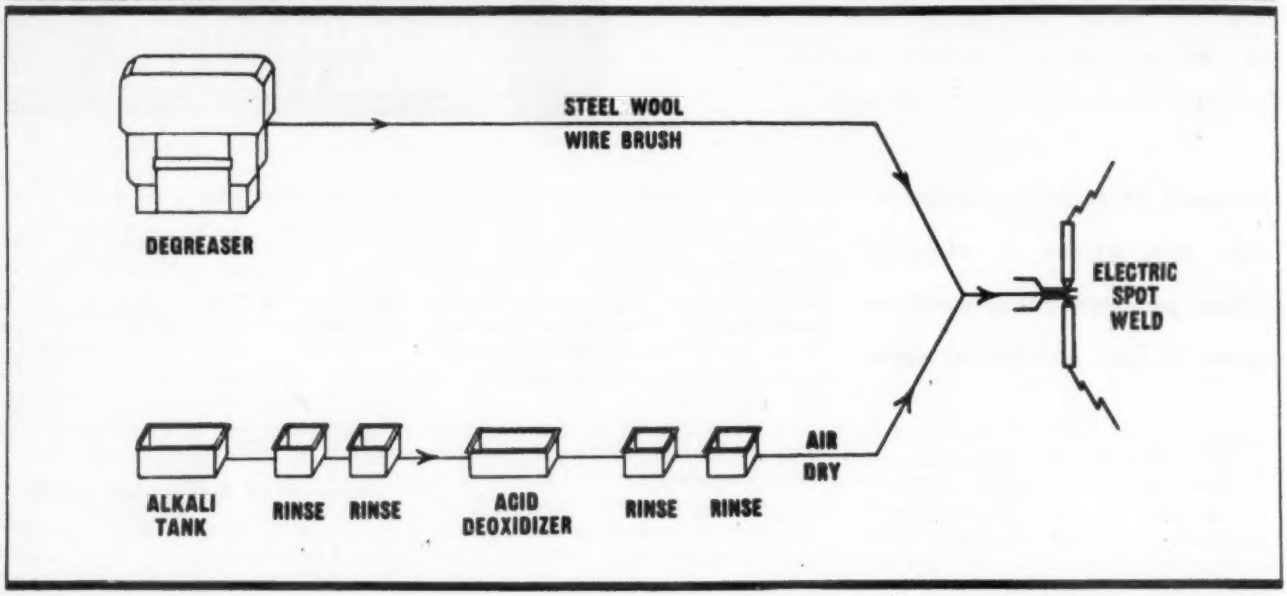
Removal of Buffing Compound

Aluminum fabrication is currently related to aircraft manufacture, but the subject of removing buffing compound from ornamental items can be treated briefly. If sufficient paraffin or petrolatum is present in the binder, the buffing compound can be removed by solvent degreasing. Often abrasive smut remains, and sprays are necessary to dislodge this type of dirt. Degreasing equipment of special design, incorporating high pressure sprays, has been used. In addition, mechanical washers employing emulsions, alkalis and oleum spirits may be used to advantage as a preceding step before the treatment process, if design and weight of parts permit.

CLEANING OF ALUMINUM ALLOYS FOR ANODIZING, ALZAC AND ALUMINUM COLORING



CLEANING OF ALUMINUM FOR ELECTRIC SPOT WELDING



There are no untreated aluminum parts used in aircraft manufacture, whether they are painted or not. After preliminary cleaning either by solvent degreasing to remove mineral oil, or in an alkali tank, the parts are placed in the alkali-cleaning tank and then double rinsed before going into the treatment tank. The aluminum cleaner is often agitated by a circulating pump since the cleaning temperature is maintained below the boiling point. Many installations involve considerable gallonage and uniform temperature should be maintained throughout the solution.

Surface Oxidizing Treatments

The equipment layout for processing aluminum alloys for anodizing, Alzac and aluminum coloring is identical in all cases. Anodizing and Alzac are both electrical processes in which the aluminum is made the anode. A surface oxide of aluminum is produced which materially improves the corrosion resistance of the metal and furnishes an excellent paint base. The anodized aluminum alloy can be dyed with certain colors which mordant directly with aluminum; dyed work is finally sealed to set the dye and close the capillaries of the anodized coating.

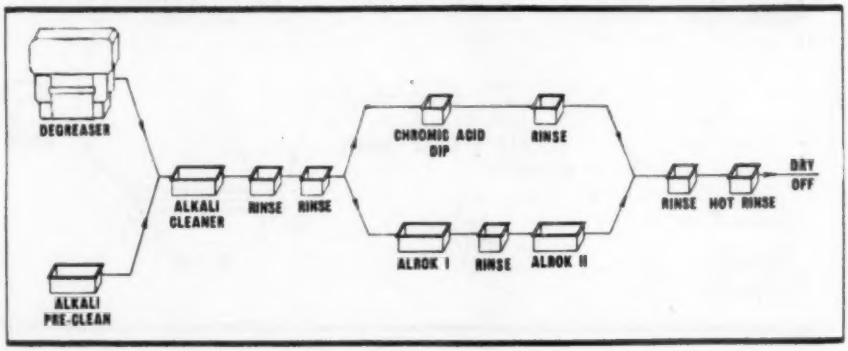
Alrok is an immersion process which produces a softer oxide coating than the anodizing process. This is particularly adapted to rivets, since they present a problem in making a good electrical contact for anodizing. The Alrok treatment is a good base for paint or prime coat. Chromic-acid dipping after alkali cleaning will form a passive aluminum surface which is also a good preliminary treatment for paint.

The cleaning and rinsing procedure for anodizing, Alzac, Alrok and chromic-acid dipping is identical. There are cases, however, where an acid dip of the same kind as used before spot-welding is of advantage in removal of surface products. Also, caustic soda is sometimes used as an etch to produce a rough surface for a two-tone appearance or a roughened surface for painting. The stripping of oxide films can be done with alkali, chromic acid-sulphuric acid, or chromic acid-phosphoric acid.

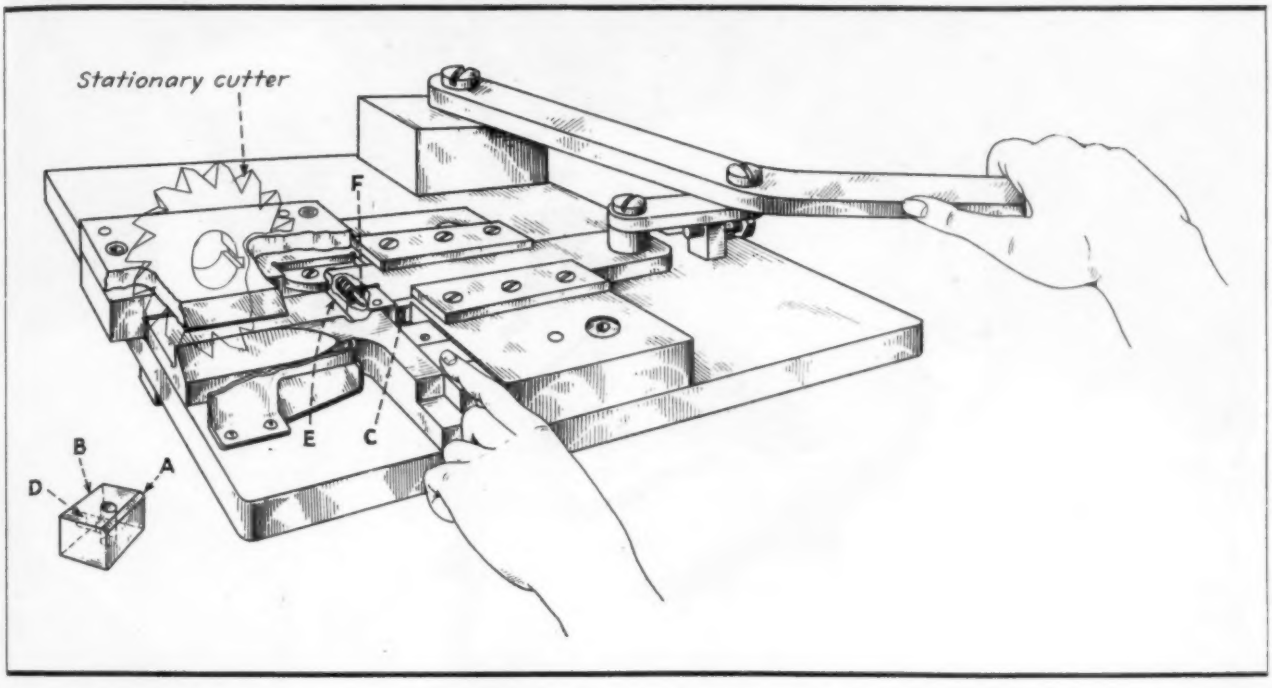
The cleaning of aluminum and removal of surface oxidation are essential to produce a good spot weld. When the preliminary cleaning is done with solvent degreasing, the surface is usually hand scrubbed with stainless steel wool or wire brushed with a wheel of the same material. When cleaning is done in an alkali tank, the aluminum work is rinsed, then dipped in a solution of chromic acid-phosphoric acid or chromic acid-sulphuric acid or phosphoric acid to remove oxidation products from the surface. Surface products offer high resistance and create the greatest problem in aluminum spot welding. The acid step eliminates hand scrubbing with steel wool or wire brushing. The "deoxidizing" dip, in every case, is preceded by cleaning with alkali and rinsing. Solvent degreasing is often a preliminary step to alkali cleaning.

(*To be continued in an early number*)

CLEANING OF ALUMINUM ALLOYS FOR ALROK AND CHROMIC ACID DIP



Ideas From Practical Men



Blocks loaded in this fixture are pushed under a stationary cutter for chamfering one corner. Blocks set incorrectly in the feed slot lock the slide and prevent chamfering a wrong corner

Blocks Chamfered In Push-Through Fixture

BY E. H. GIRARDOT
GENERAL ELECTRIC COMPANY

The illustrating milling fixture was designed to mill chamfer *A* on the corner of aluminum block *B*, thousands of which were on order. The parts are loaded in the feed slot *C* with drilled hole *D* facing the back of the fixture. The first piece is positioned on slide *E* over foolproof pin *F*. The slide is then pushed under the stationary cutter to the end of its stroke, where the chamfered aluminum block drops off the end of the fixture.

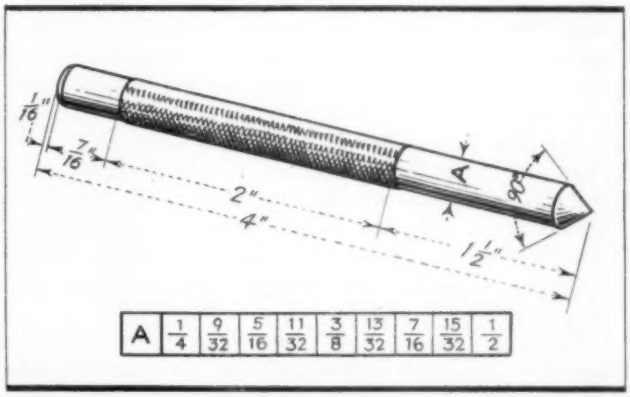
Were the part to be reversed in loading, foolproof pin *F* would stop the part out of position, thus locking the slide. To facilitate unloading, the foolproof pin is arranged to retract automatically from the part as the slide is advanced, leaving the part free to fall from the fixture. A permanent guard fully covers the cutter, protecting the operator from the safety hazard involved. Rejects, common before this fixture was designed, have been eliminated.

Center Punch for Accurate Layout

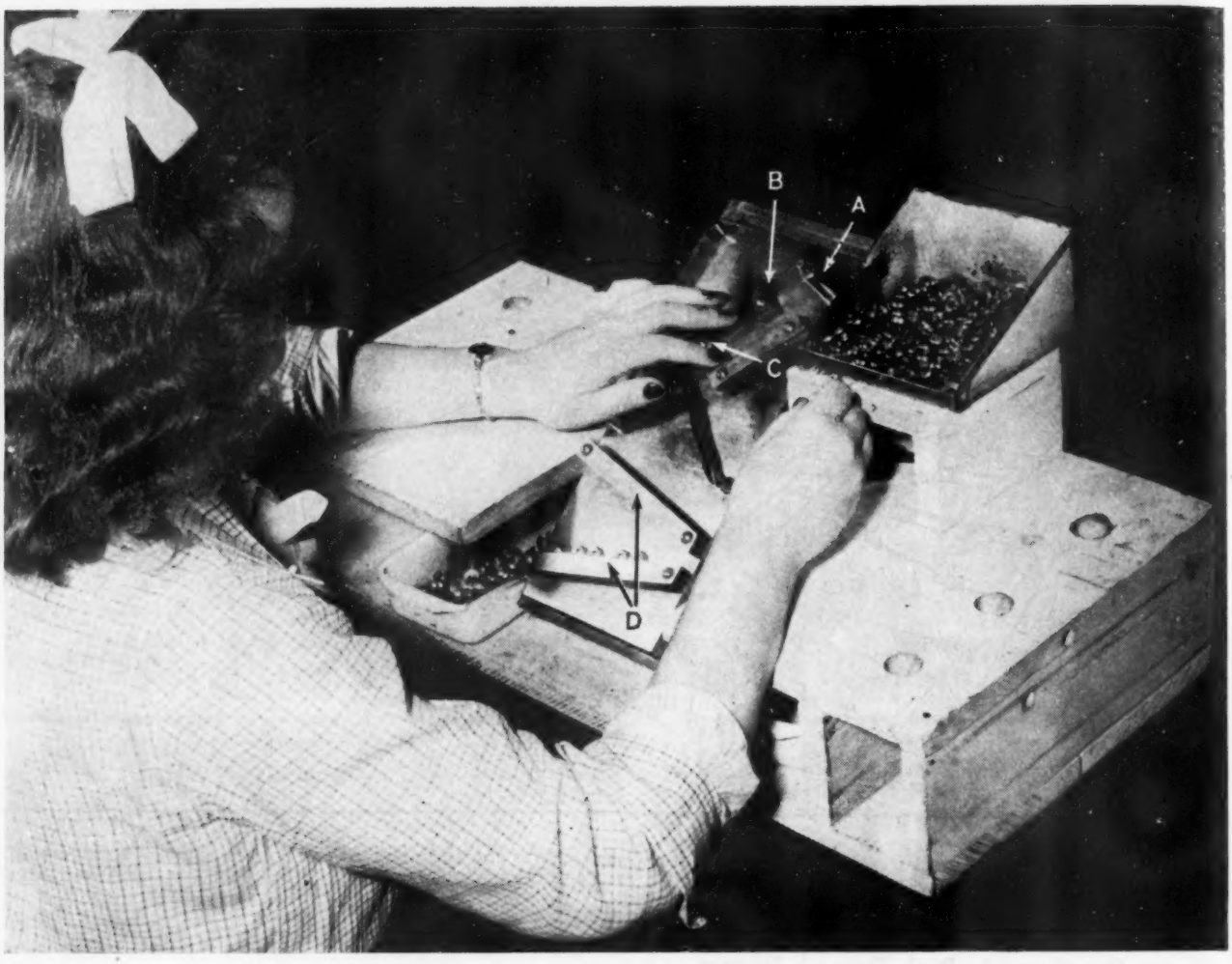
BY C. F. FITZ

The plate department in our plant was having considerable difficulty in matching holes drilled in mating plates of subassemblies. This was true regardless of the fact that one plate was drilled first and used as a templet to layout the mating plate. The difficulty was overcome by making sets of precision center punches to the dimensions shown in the drawing.

The punches are made from drill rod, and after heat-treating, the point angle of 90 deg. is ground. In use, it is simply a matter of lining up the plates, inserting a center punch of the proper size in the drilled plate, and center punching the hole location in the mating plate. Obviously, dimension *A* on these punches correspond to the diameters of the holes in the drilled plates. Since making the punches, rejects have been reduced materially, and production in the plate department has increased.



Punches with body diameters corresponding to holes in layout sheets or templets make accurately located center marks for drilling holes in sheet metal



Three dimensions on washers are checked by gages mounted on this inclined table. The washers fall by gravity to gaging stations and receptacles. Rejects fall automatically into separate bins

Washers Inspected on Gravity Table

BY A. E. SITES
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

The inspection of steel washers on which three dimensions must be checked accurately is speeded by the use of the illustrated table on which the washers fall by gravity from each gaging station. The washers are machined to close tolerances, the inside diameter being held to plus or minus 0.003 in., the outside diameter to plus 0.000 in. minus 0.003 in., and the thickness to plus 0.000 in. minus 0.008 in.

The inside diameter is checked first on a single-end "Go" and "Not Go" plug gage *A*. Washers which fail to pass are dropped into an area from which they fall by gravity into a scrap pan. Those which pass first inspection then proceed to the outside-diameter gages *B* and *C*—undersize washers passing through "Not Go" gage *C* fall by gravity into the scrap pan.

Parts of satisfactory diameter slide down to thickness gage *D*. Over thick washers roll into the scrap pan before passing through the gage. Undersize washers fall into a separate container. Those which are satisfactory are stopped in a final area and ejected by an air jet.

The steel plate forming the base of this gaging table is inclined at 45 deg. to provide a comfortable working position and to permit the parts to move as much as possible by gravity. Gage blocks are used for checking the gages periodically, while master rings check the plug gage. All gages are kept adjusted to within 0.005 in.

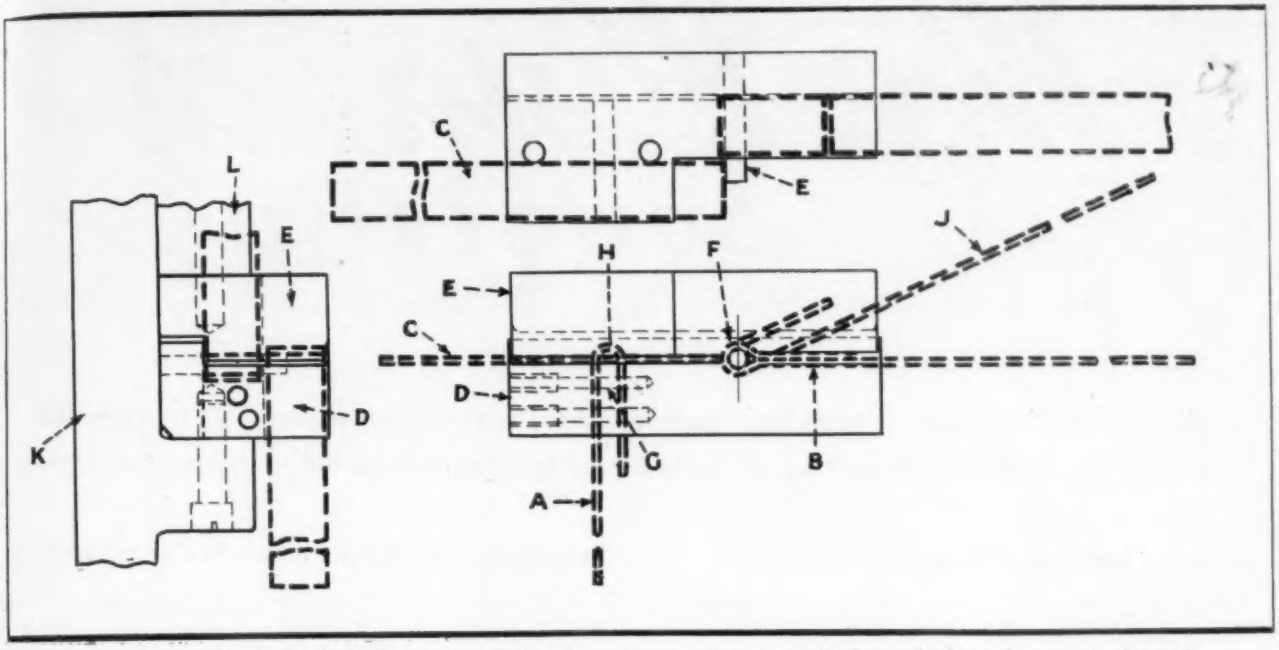
Vise Bends Eye on Strip Stock

BY FRANK HAARTLY

In bending an eye on strip stock with the device shown in the drawing, the work is held successively in two positions in the vise, one for forming the U-shape shown at *A* and one for forming the eye shown at *B*. The strip stock *C* is first placed between fixed jaw *D* and movable jaw *E*, and located against pin *F*. When the vise is closed, block *G*, which is an integral part of jaw *D*, co-acts with a groove *H* in movable jaw *E*, thereby forming the U-shape shown at *A*.

To close the U-shape into an eye, the work is placed over pin *F* in the position shown at *J* and then is swung into line with the open vise jaws. In each section of the jaws is a groove about pin *F* which forms the eye when the vise is tightened.

The vise used for this work is the type used on a plain



An eye can be formed on flat strip in this vise. The stock is bent U-shape before the eye is shaped

milling machine, the base of the vise being shown at *K*. A portion of the movable slide is shown at *L*. The working portions of the vise jaws and block *G* are raised above the vise proper for the first operation, while the final forming is done with the work below the top of the vise where the jaws are well supported.

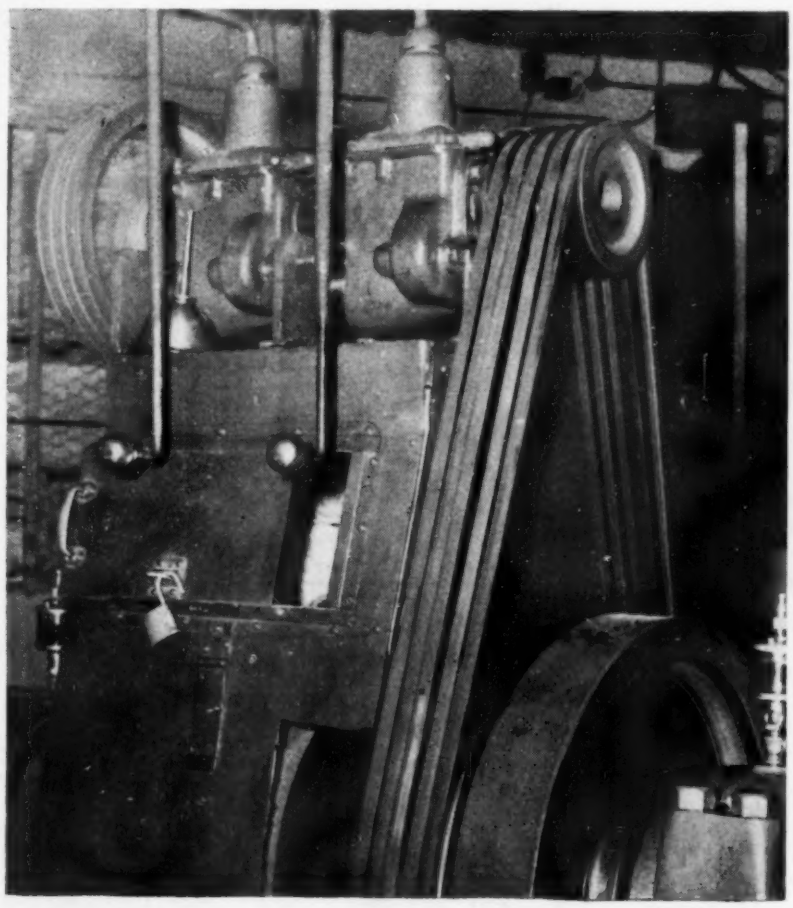
Lathe Speeds Changed By Ford Transmissions

By R. E. TILLOTSON

Motor machinist mate G. E. Beard, stationed at the Submarine Chaser Training Center, Miami, Fla., found it desirable on a certain submarine job to have a quick means of reversing the spindle on an engine lathe. High and low speeds were also required. He accomplished this by mounting two Ford automobile transmissions in tandem on a bracket above the headstock as shown in the illustration.

The brackets that support the two transmissions is made of heavy strap metal reinforced by gussets and cross braces. The assembly is bolted to the lathe bed, and covered with sheet metal.

This set-up furnishes 34 spindle speeds, 17 forward and 17 reverse, ranging from 1 to 185 r.p.m. Multiple V-belt sheaves are mounted on the transmission shaft, the V-belts running on the regular flat cone wheel on the headstock spindle. The regular gear-shift levers were replaced by ones which are U-shaped and extend to a point alongside the headstock to facilitate making speed changes. When necessary to turn the lathe spindle by hand, the transmissions are set in neutral position. Power is supplied by an individual motor, a remote control for which is mounted on the lathe carriage.



Two Ford Automobile transmissions mounted in tandem, and coupled by belts to the spindle of this lathe, furnish 17 speeds in both directions, ranging from 1 to 185 r.p.m.

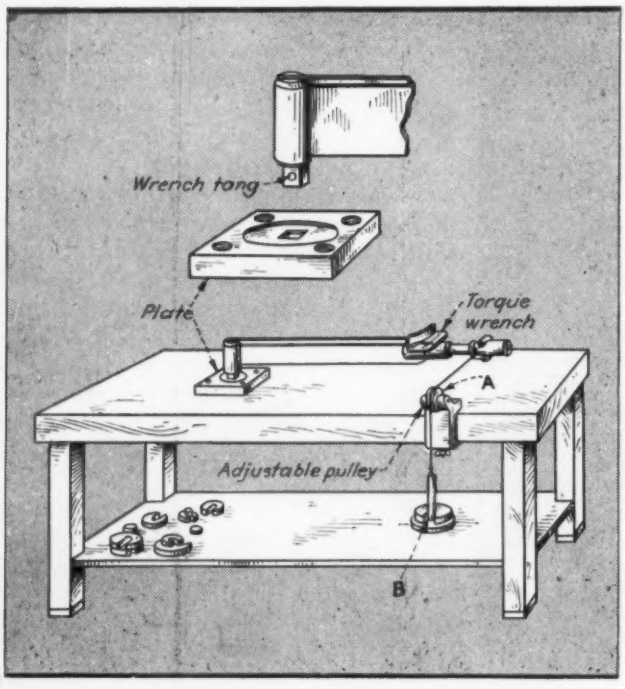
War Winning SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.

Accuracy for Torque Wrenches Checked

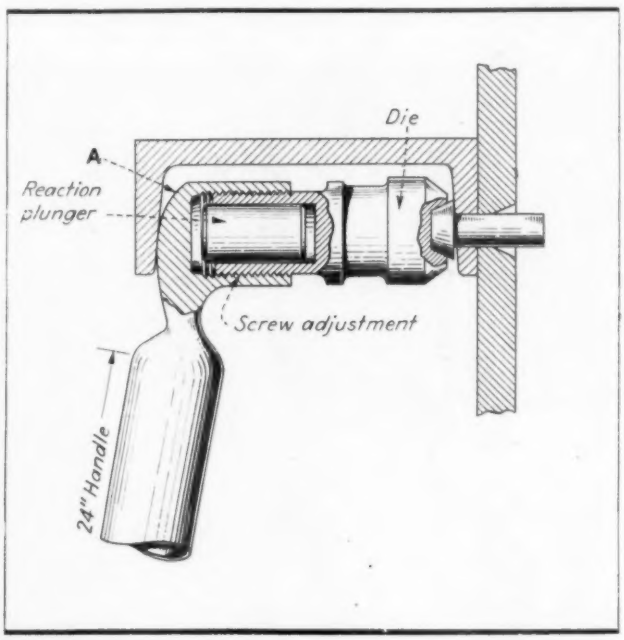
Tightening bolts and driving studs with torque wrenches is the standard method of insuring uniform stress loads on these parts in aircraft engines. Since the exactness of this operation is dependent on the accuracy of the wrench, it is essential that a quick method be available for checking the correctness of their dial readings. With no suitable device available, the illustrated equipment was designed. It has proved to be entirely satisfactory.

The torque wrench is held as shown with the square tang in a square hole in the plate bolted to the table. A wire cable is attached to the center of the handle and passes over adjustable pulley *A* which is so positioned that the cable is perpendicular to the axis of the wrench. Weights *B* are then added to the end of the cable and charts show the actual pull in foot-pounds or inch-pounds for any given weight. These readings are then compared with those on the wrench dial. *Suggested by Herbert Williams, Aircraft Engine Division, Packard Motor Car Company.*



Telescoping Bar Drives Rivets in Close Quarters

Shell rivets in the 6-in. frames between decks in holds Nos. 2, 3 and 4 on C-2 cargo ships are difficult to buck up and often are so loose that they must be chipped out. On each hull, an average of 200 rivets in these small frames had to be cut out and redriven. This has been eliminated completely through the use of the illustrated buck-up bar. Furthermore, handling the conventional riveting dolly contributed to operator fatigue. This has been greatly minimized by the telescoping buck-up bar.



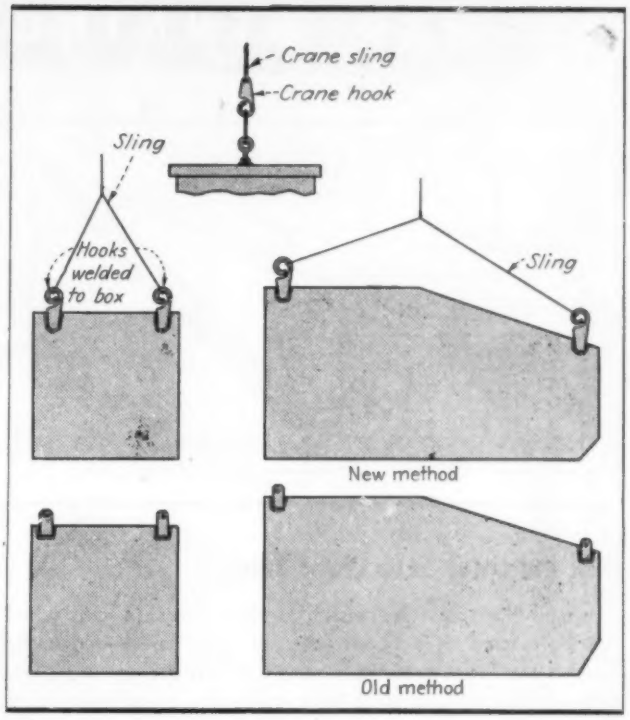
The tool is comprised of a rivet die set carried on a telescoping extension of a lever arm which can be set by screw adjustment to fit frames of various widths. The heel of the lever is rounded at *A* to bear against the inner surface of the frame flange. Thus, the rivet die may be centered over the rivet and held there while the latter is being driven. A plunger, driven by the reaction of the rivet gun, serves to pound the inboard head of the rivet down against the frame flange. *Suggested by M. Umbraco, Richmond Shipyard No. 1, Permanente Metals Corporation.*

Mitering Fixture for Metal-Cutting Saws

The illustrated fixture is used on Do-All saws for cutting angles up to 45 deg. on tubing and round stock. The fixture fastens to the miter cut-off attachment furnished with the machine, taking the place of the 3/8 in. steel plate, and can be used with the power feed attachment for heavy work. This speeds production when sawing duplicate parts.

Base *A* of the fixture is made from 1/4x2 1/2x2 1/2 in. angle iron, one end of which is beveled 45 deg. A 1/4x1 in. steel bar *B*, rolled to 2 1/8 in. diameter, is welded to base *A* 4 in. from the beveled end. Clamp screw *C*, fitted with ball-jointed shoe *D* and welded angle iron *E*, holds the work in the fixture. Hardwood block *F* is used to hold work of small diameter. Location of holes *G* are for fastening the fixture to the miter attachment on a V-36 Do-All saw; they can be relocated for other models.

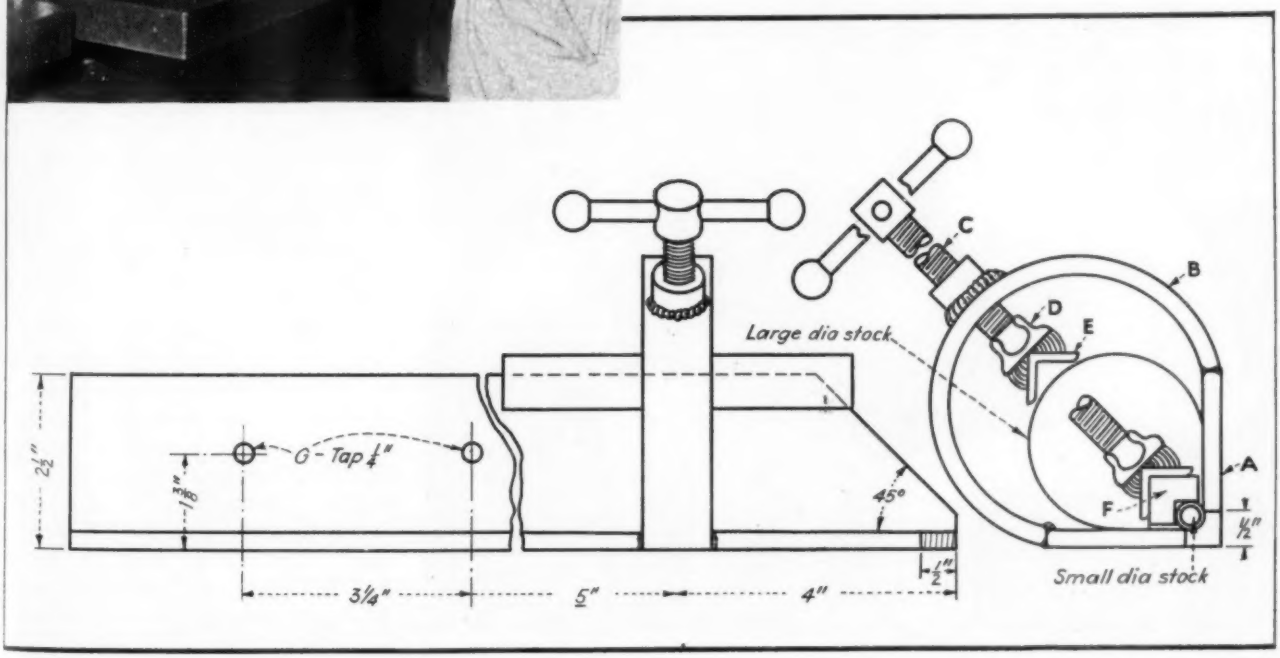
It is estimated that each fixture saves 300 man-hours each year in the production of beveled tubing and round stock. *Suggested by W. H. Cochran, United Air Lines Transport Corporation.*



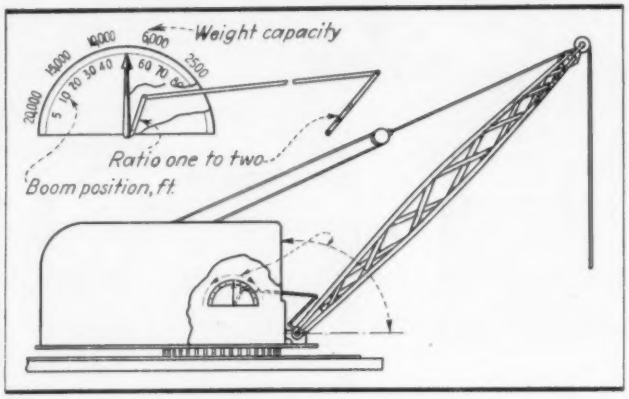
Safety Hook Cuts Crane-Handling Time

The illustrated hook replaces two shackles commonly used at each lug on the corners of trash boxes when handling them by crane. It is so designed that the sling will not come loose; furthermore, it will not catch on any object which it might contact.

The hook eliminates the application and removal of shackles and saves 6 min. when making a lift. In one shop where 30 lifts a day were made, a little more than three hours were saved. The safety features of the hook lead to its use on crane cables. *Suggested by J. H. Barksdale, Gulf Shipbuilding Corporation.*



★ WAR-WINNING SUGGESTIONS ★



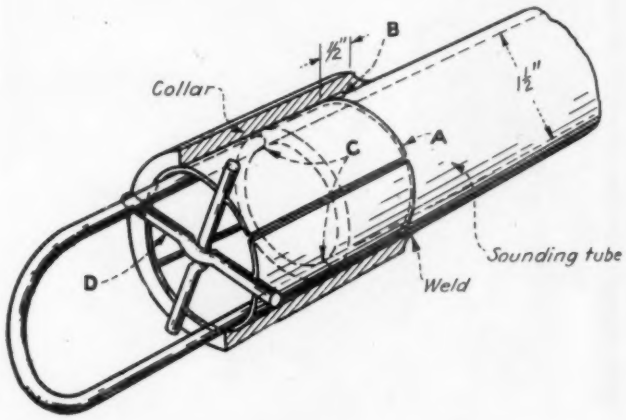
Dial Indicates Safe Crane Loads

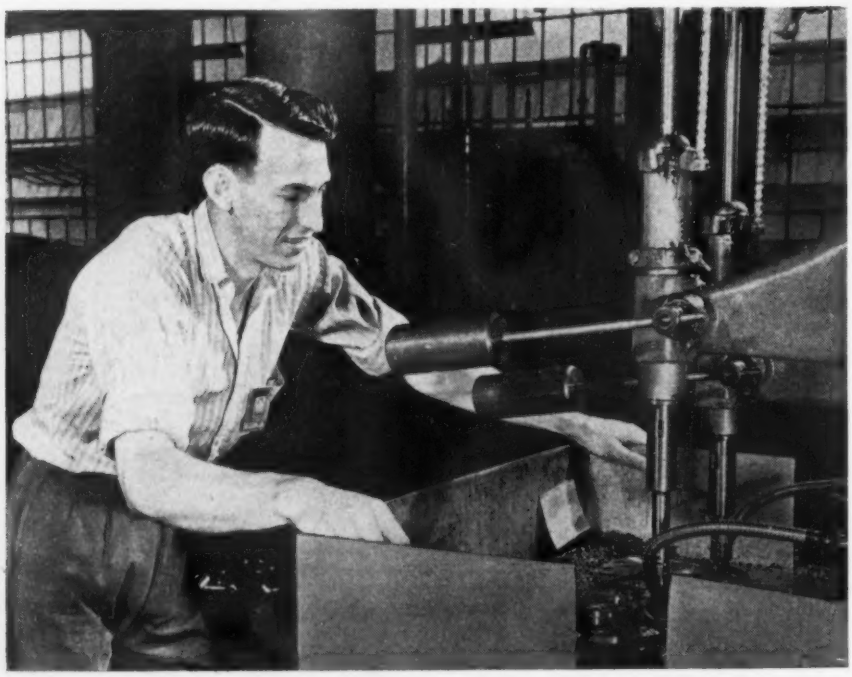
Crane operators frequently question the safe load which can be carried by a boom when it is in various positions. Guesswork with the resultant safety hazard can be eliminated by a scale graduated to reveal the safe load for various boom positions, the dial being actuated by linkage between the scale and the boom. The scale shown in the illustration gives the safe load when the boom ranges from 5 to 80 ft. from the vertical. This device has proved particularly useful on small portable cranes. *Suggested by T. W. Thomas, Marinship Corporation.*

Welding Jig Holds Pipe Collars Concentric

The collars or sleeves used on the sounding tubes of C-2 cargo ships are sections usually made from the next larger size of pipe. It has been the practice to hold these collars by hand while welding them to the tubes, with the result that they are seldom concentric with the tubes. This difficulty has been eliminated through the use of a jig comprised of a sheet-metal shim *A* the thickness of which corresponds to the gap *B* between collar and tube.

In the 1½-in. tube shown in the drawing, the inside diameter of the collar is about 1/16 in. large than the outside diameter of the pipe to which it is to be welded. Circular split shim *A*, 1/32 in. thick and representing the difference in diameters between the pipe and collar, is inserted into the collar. This centralizes the pipe and collar, since the pipe enters the shim until it hits the ends of handle *C*. With the shim thus located, the collar is pushed against cross-bars *D* welded to the shim. With both the collar and the pipe against their respective stops, the shim is about ½ in. from the end of the collar so that it will not be affected when welding the assembly. *Suggested by R. W. Day, Richmond Shipyard No. 1, Permanente Metals Corporation.*



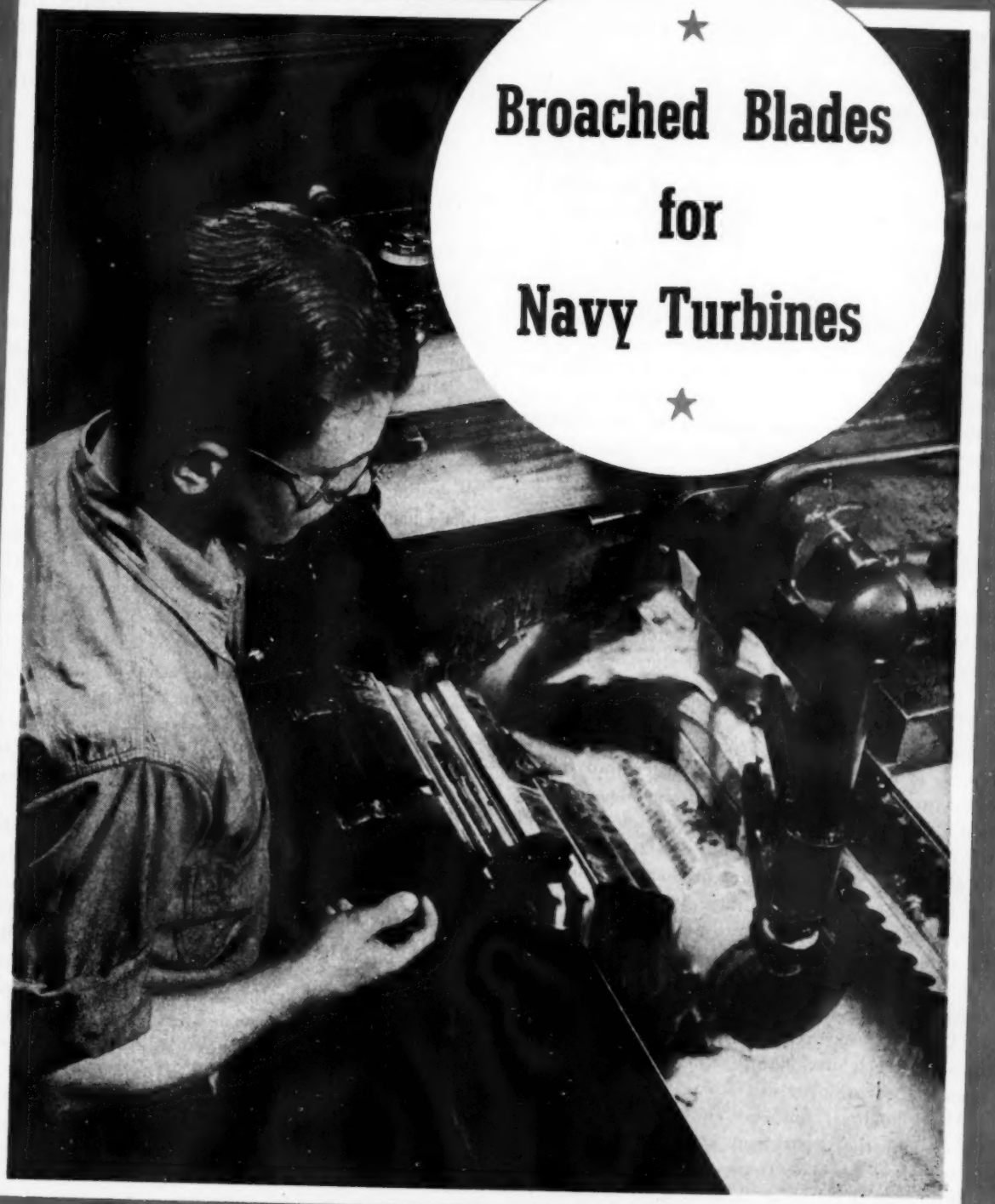


Weighted Lever Feeds Spotfacing Tool

Two sensitive drills mounted over one table were being used to spotface 12 holes in each of two flanges. The two operators on the job placed the flanges on the table and fed the drill press spindles by hand. Slidable weights were fitted to the spindle feed levers so that instead of physically holding the spotfacing tool on the flange, this is accomplished automatically. The weights can be adjusted on the levers to produce the pressure necessary for the finish desired. This not only resulted in a more satisfactory finish, but it permitted one operator to run two presses with no extra effort and at the same time increase production. *Suggested by John D. White, Cadillac Motor Car Division, General Motors Corporation.*

Armament

SECTION OF AMERICAN MACHINIST



Broached Blades for Navy Turbines

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BROACHED BLADES FOR NAVY TURBINES

SURFACE BROACHING has been applied successfully in the manufacture of spindle blades for three sizes of marine turbines now being produced in considerable quantity for the U.S. Navy. When this contract was undertaken, an entirely separate department was set up in one of the Allis-Chalmers plants for two reasons. First, design of the blades is different from those normally used in Allis-Chalmers steam turbines. Secondly, the size of this contract made a separate control center advisable to insure economy of operation and quality.

In all, 66 different blades are required for the three sizes of turbine spindles involved in this contract. These blades are made from a corrosion-resisting stainless steel which is specially heat-treated. The rectangular bars of blade stock are purchased to exact lengths so they can be cut to the lengths of blades in the various stages without excessive waste. Hardness of the stock is about 200 to 240 Brinell.

In the past, turbine blades of the types required for these spindles have, in almost all cases, been milled to shape in a series of operations like those described in the article "Tools for Navy Turbine Blades" published some time ago. However, after analyzing the operations required to manufacture these blades, it was decided that the quantities required for each size would justify the expense required to install surface broaching machines and the necessary tools. The number of blades in a single row or stage on these spindles ranges from a minimum of 121 to a maximum of 279 blades. All blades have a yoke-type root; because of the range of blade sizes there are three different root styles, with one, two and three dovetail slots, respectively.

Adequate Tooling Promotes Efficiency

In setting up a new department to make these blades, it was not possible to transfer into the department men familiar with turbine-blade production. It is of particular interest to note that while the manufacture of turbine blades was entirely new to all of the supervisors and production workers in the new department, little difficulty was encountered in getting the department into production and manufacturing efficiency has been high from the very start. An operation sheet showing a sketch of the part as finished at the work station, the dimensions to be held, and listing the tools and gages required, is furnished each machine operator. This practice has simplified the problem of training new operators.

Work-holding fixtures and other tools used throughout the department were designed to be as foolproof as possible, so that the training time for new operators could be held to a minimum. It is almost impossible to put a work piece in the wrong position in a fixture and then operate the machine. This practice has the added advantage of holding accidents at a low level and of helping to keep the department's scrap loss ratio down to a minimum value. Periodic floor inspection of blades in process at each work station has been found to result in better workmanship and a further reduction of scrap.

Though there is considerable variation in the size of the different blades, and it was necessary to provide equipment to machine the three different shaped roots, it has been possible to develop manufacturing procedure for all of the blades in which the various production steps are virtually the same for each size of blade. Operations and tools shown in accompanying illustrations are for this and similar blades.

Employ Horizontal Broaching Machines

As many operations as possible are performed on horizontal hydraulic surface broaching machines, with 15-ton units being employed for slab broaching and 10-ton machines being used for the form broaching. All of the horizontal broaching machines have a 90-in. stroke. The broach bars used in these machines range in length from 110 to 120 in. and the broach sections fitted into these bars range from 5 to 12 in. long, depending on the operation and the amount of stock to be removed by each section.

Broaching speed ranges from 17 to 32 ft. per min., depending upon the operation and the size of the blade being broached. Broach sections are removed from the broach bars for resharpening as needed, then are reset on the bar in accurate alignment with the other sections. Experience has shown that the average broach section is good for about 10,000 pieces before resharpening is necessary. Slabbing broaches have a 15 to 18 deg. lip angle, a 20 deg. rake angle and a 2 deg. relief back of the cutting edge on the roughing teeth. This relief is reduced to 1½ deg. on the finishing teeth. Form broaches in most cases have teeth ground to the same cutting angles, except that the rake angle usually is about 15 deg.

As shown in the accompanying operation sketches, the first operation consists of cutting off the blade stock to within 0.010 to 0.015 in. of the required blade length in a Campbell abrasive cut-off machine. Blade stock is selected so that dimensions *A* and *B* are such that a minimum amount of material must be removed to make the blade. For the blade under discussion, these dimensions are 13/16 in. and 2-3/16 in., respectively. Dimension *C* for this blade is 3-11/16 in.

For the cut-off operation the stock is laid flat on the table of the machine because experience has shown that the wheel has less tendency to lead off to one side when it first contacts the work at about the center of one of the flat sides. A stop is fixed to the table so that the operator need only feed the bar

against the stop in order to cut the bar off to the desired length. A length gage is provided so that the operator can check dimension *C* from time to time as the operation progresses.

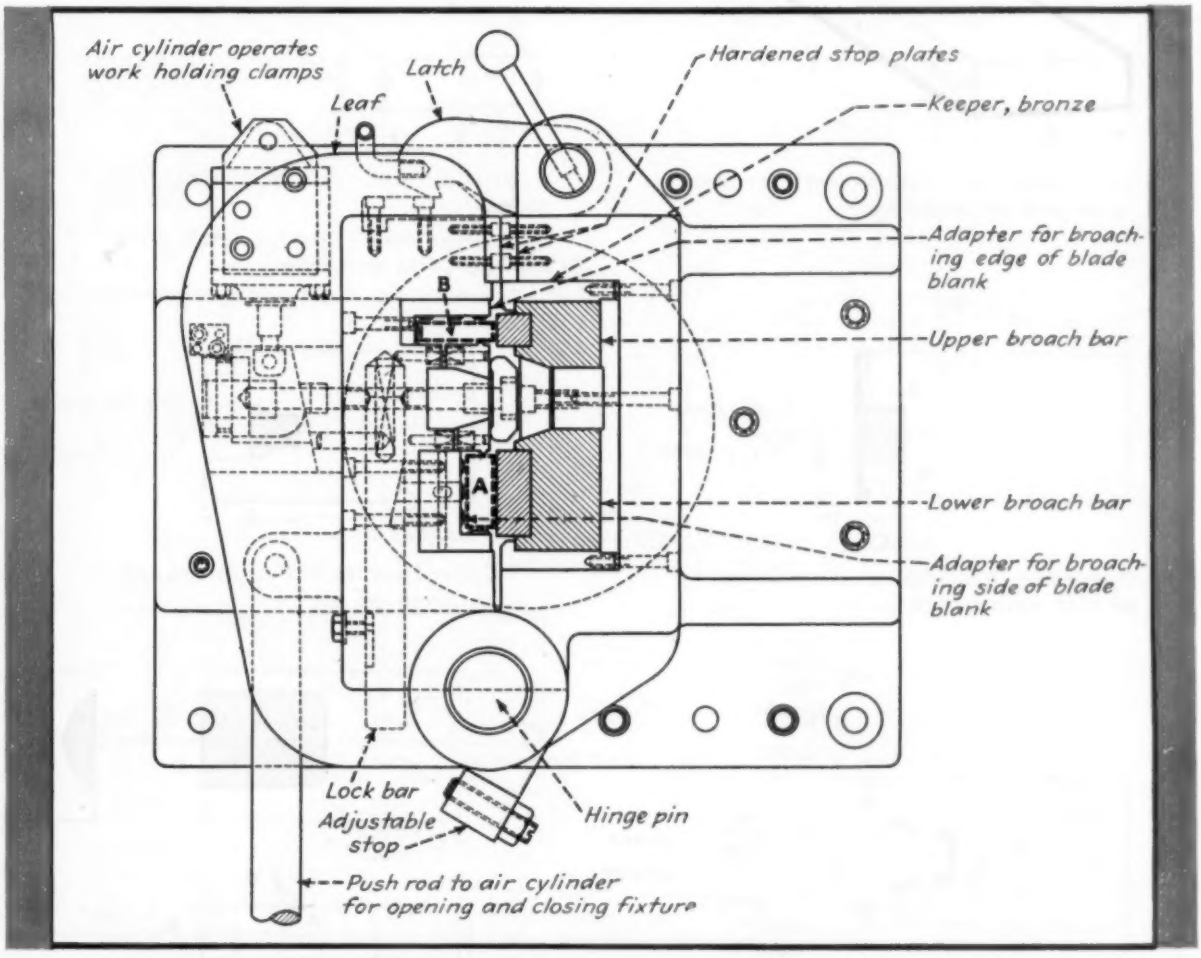
During the cut-off operation the work is flooded with a soluble oil cutting compound. After the operator has stamped the part symbol on the piece he places it on the tray of a special shop truck having an oil reservoir into which the cutting compound is drained while the parts are moved to the next operation. These trucks are used throughout this department for moving the blades between work stations and they are arranged to hold all sizes of blades. By using these trucks, oil and other cutting compounds are kept off the floor and sizable amounts of the fluids are recovered.

The second operation on each blade blank consists of grinding off the burrs raised during the cut-off operation. A disk grinder is used for this purpose.

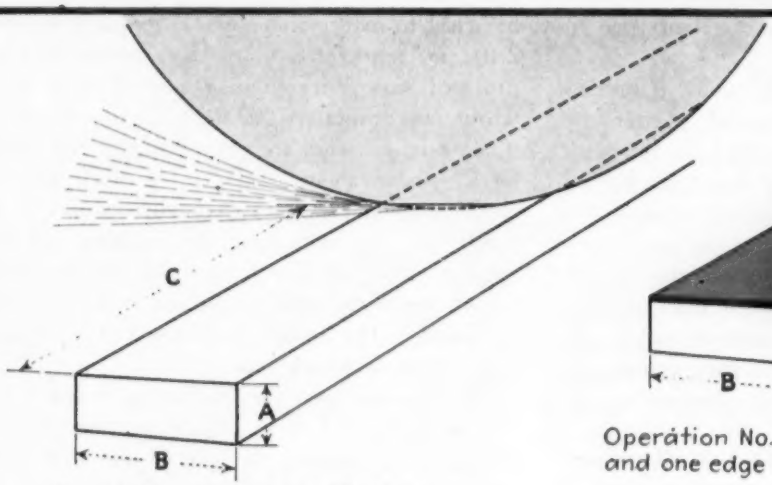
The third and fourth operations consist of slab broaching the two sides and two edges of each blank to bring it to size for surface grinding. In the first of these operations, approximately 3/64 in. of stock is removed from one side and one edge while in Operation 4 the second side and second edge are slab broached to reduce dimensions *A* and *B* to 0.730 and 2.102 in. respectively. Indicator setting blocks are provided since dimensions *A* and *B* must be held within plus or minus 0.002 in. in the fourth operation.

Slabbing broaches are ground so that the roughing teeth remove about 0.003 in. of stock per tooth. Stock removal per tooth gradually reduces to about 0.0005 in. per tooth near the finishing end of the broach. The last five or six teeth on each slabbing broach are of the same height and remove practically no metal. The broach bars are 119 in. long and have 77 in. of broach inserts.

The fixtures used for Operations 3 and 4 are of the swinging leaf type. Each of these fixtures is arranged for slabbing the side of one piece and the edge of a second piece at each pass of the broach bar. The blank first is put in position *A* in the fixture for slabbing one side, and then for the next pass of the bar this piece is transferred to position *B* for slabbing one edge while one side of a second piece is being cut at position *A*. The fixture is opened and closed

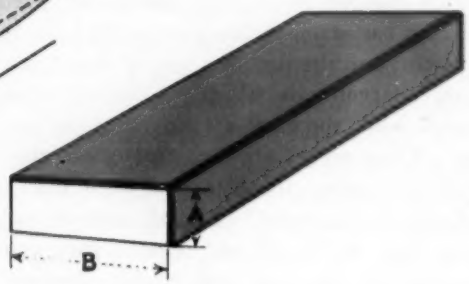


This swinging-type fixture for a slab-broaching operation is arranged to hold two blanks at a time in positions A and B. An air cylinder under the fixture opens and closes the outer assembly, which swings on the lower hinge pin. The small air cylinder actuates a locking mechanism which holds the blanks in place

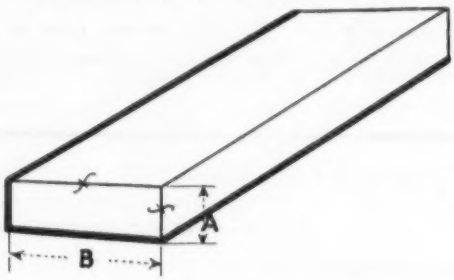


Operation No.1 - Cut off blade length from bar

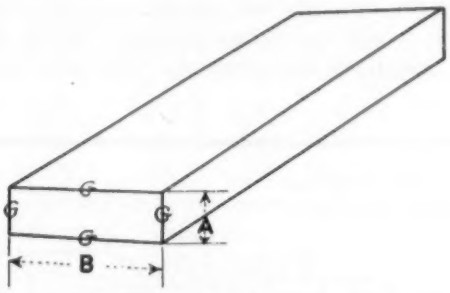
Operation No.2 - Grind off burrs



Operation No.3 - Slab broach one side and one edge

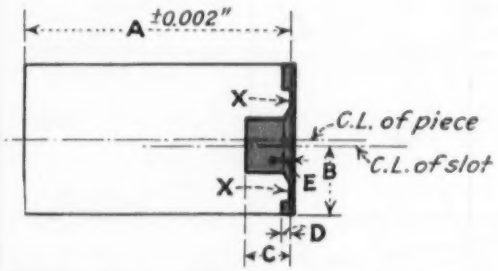


Operation No.4 - Slab broach second side and second edge

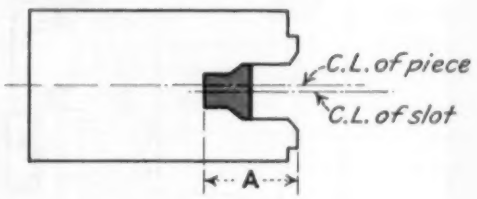


Operation No.5 - Surface grind four sides

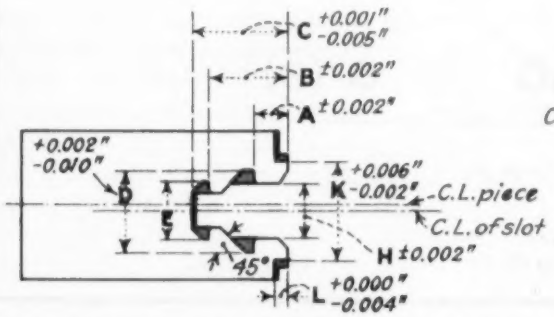
Operation No.6 - Electric etch part number, file and clean



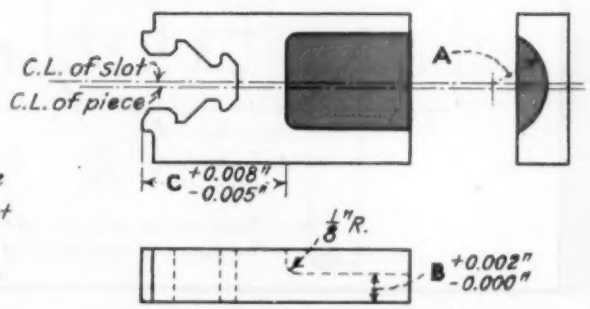
Operation No.7 - Rough broach part of slot and bottom fit



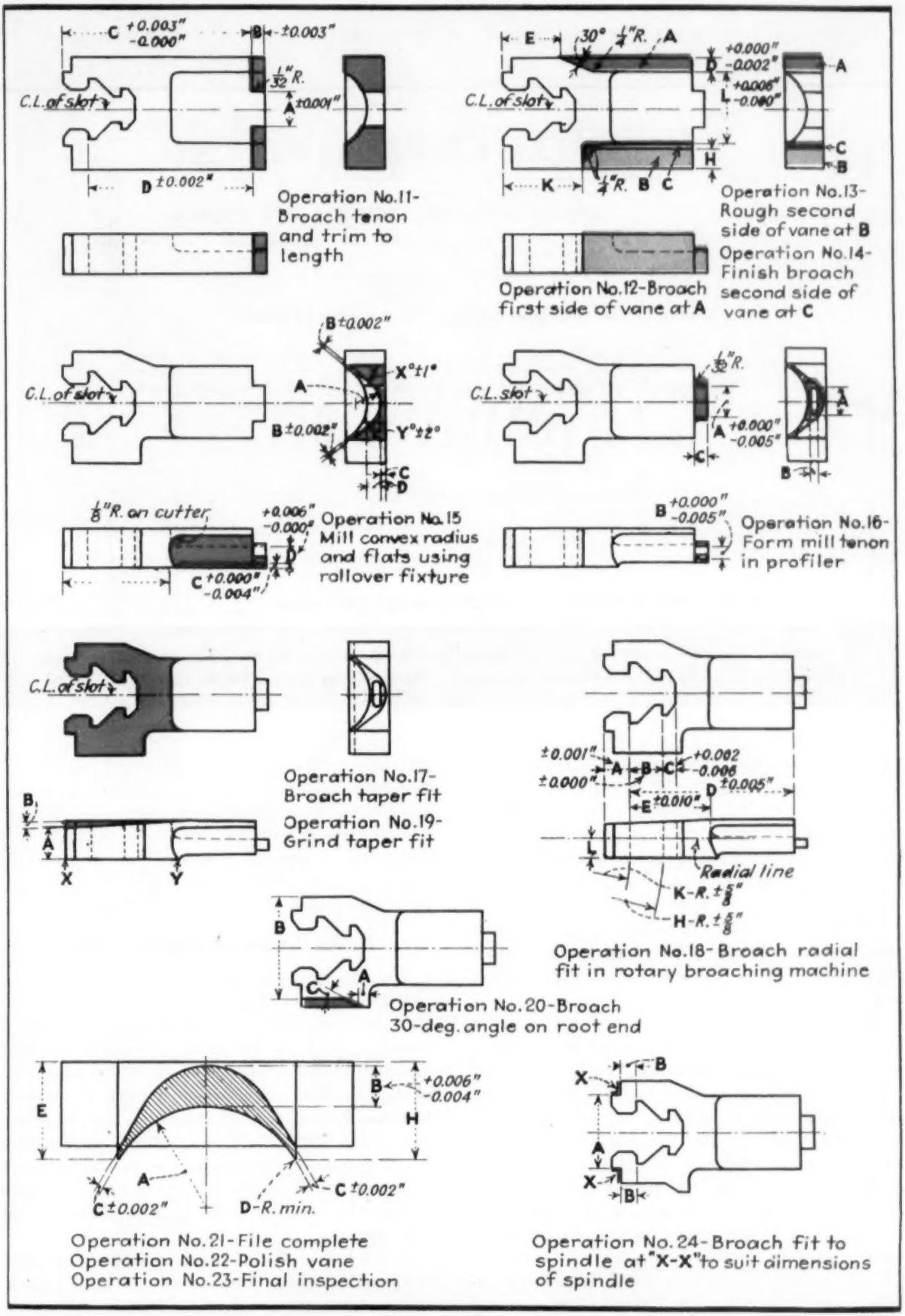
Operation No.8 - Rough broach balance of slot



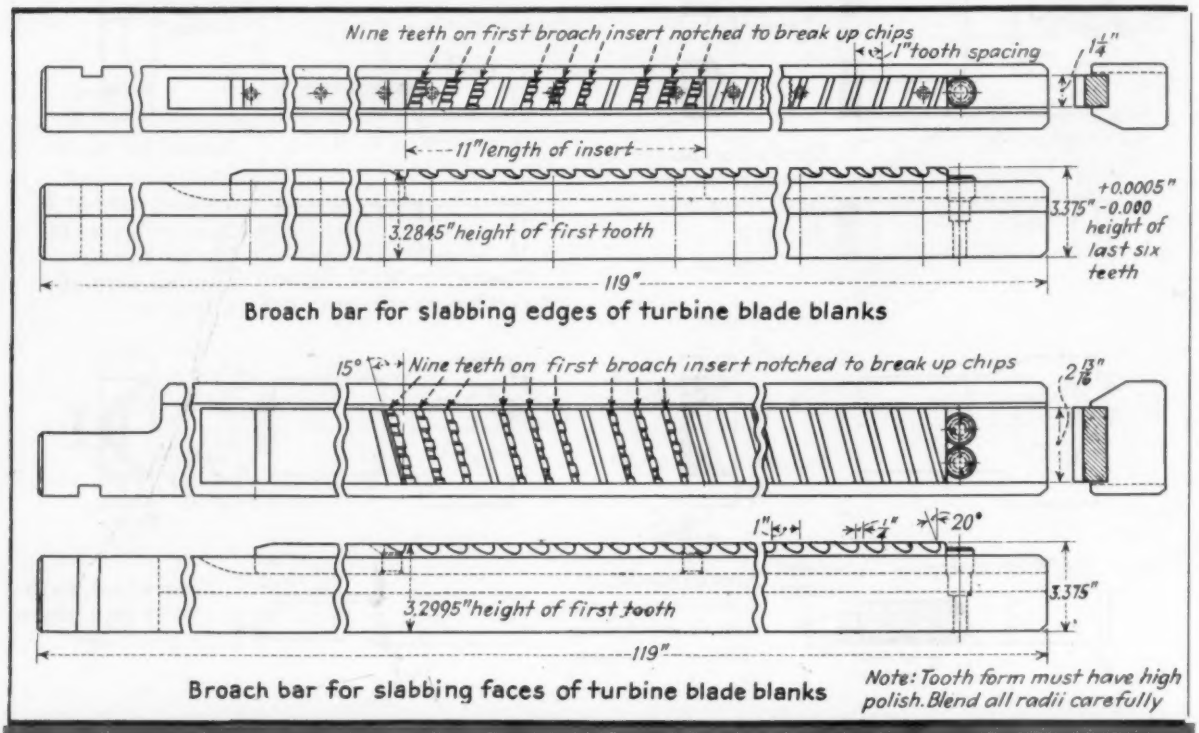
Operation No.9 - Broach dovetails and finish broach bottom fit



Operation No.10 - Plunge mill concave radius



The 24 operations sketched above are necessary for the manufacture of one of the smaller low-pressure blades for a marine-type steam turbine rotor. Most of these operations are performed on surface broaching machines. Some of the other blades require as many as 40 operations


Nine teeth on first broach insert notched to break up chips
1" tooth spacing
1¼"
11" length of insert
3.2845" height of first tooth
+0.0005"
3.375" -0.000
height of last six teeth
119"
Broach bar for slabbing edges of turbine blade blanks
15°
Nine teeth on first broach insert notched to break up chips
2 13/16"
1"
¼"
20°
3.2995" height of first tooth
3.375"
119"
Broach bar for slabbing faces of turbine blade blanks
Note: Tooth form must have high polish. Blend all radii carefully

Two broach bars are necessary where the face of one blade blank and the edge of another blade blank are slab broached in the same operation. The broaches are for blanks over 2½-in. long

by an air cylinder mounted on one side of the 15-ton broaching machine. A second air cylinder mounted on the swinging leaf operates a clamp bar to hold the pieces in positions *A* and *B* in the fixture. When the fixture is closed by operation of the lower air cylinder it is locked by an overhead latch which securely ties the two parts of the fixture together while the broach bars are pulled through. Wedge blocks made of bronze are used to keep the broach bars square with the machine and so insure parallel surfaces on the blocks.

As shown in the accompanying sketch, teeth on the slabbing broach inserts are spaced approximately 1 in. apart. Nine teeth on the first broach section set on each bar are notched to break up the chips. These notches are staggered so that each tooth will only take a part of the chip section. The tooth design shown is suitable for blanks over 2½-in. long.

Broaching speeds for Operations 3 and 4 vary with the length of the stock. Experience has shown that a speed of 32 ft. per min. is satisfactory for blanks up to 4 in. long, a speed of 24 ft. per min. is best for blanks ranging from 4 to 6 in. long, and that the speed should be reduced to about 17 ft. per min. when the blanks are longer than 6 in. A heavy cutting oil which will cling to the cutting edges of the broaches is employed for all of the form-broaching operations. However, the use of an soluble oil cutting compound for the slab broaching operations has resulted in a 20 per cent increase in tool life over that experienced when the heavy cutting oil was used. This compound is flooded over the work in large streams directed over each of the broaches used for slabbing cuts.

Blanks Ground on Magnetic Chuck

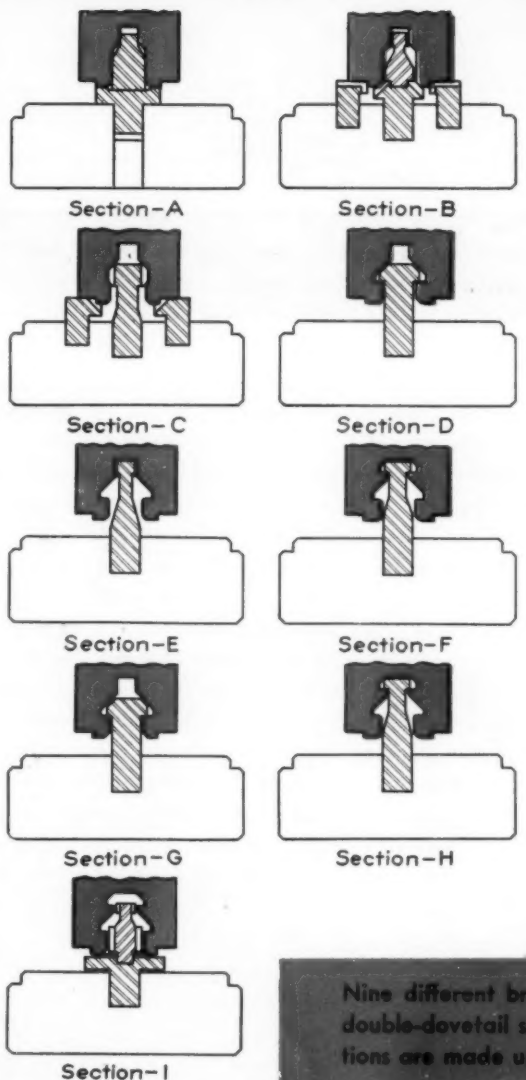
The fifth operation consists of surface grinding the two sides and two edges slab broached in the preceding operations. A large surface grinder having a magnetic chuck on the table is employed for this operation so that a number of blanks can be ground at the same time. Approximately 0.004 in. of stock is removed from each of the four surfaces, dimensions *A* and *B* being held within plus or minus 0.0005 in. The opposite surfaces must be parallel. Height gage blocks are provided for setting a dial indicator for checking dimensions *A* and *B* as finished in the fifth operation.

A bench-type electric etcher is used in Operation 6 to mark the part number on each of the blanks after it has been surface ground. The operator of this etcher also uses a hand file to remove all burrs and sharp edges. Then he cleans the parts by placing them in baskets and dipping them in a degreaser tank

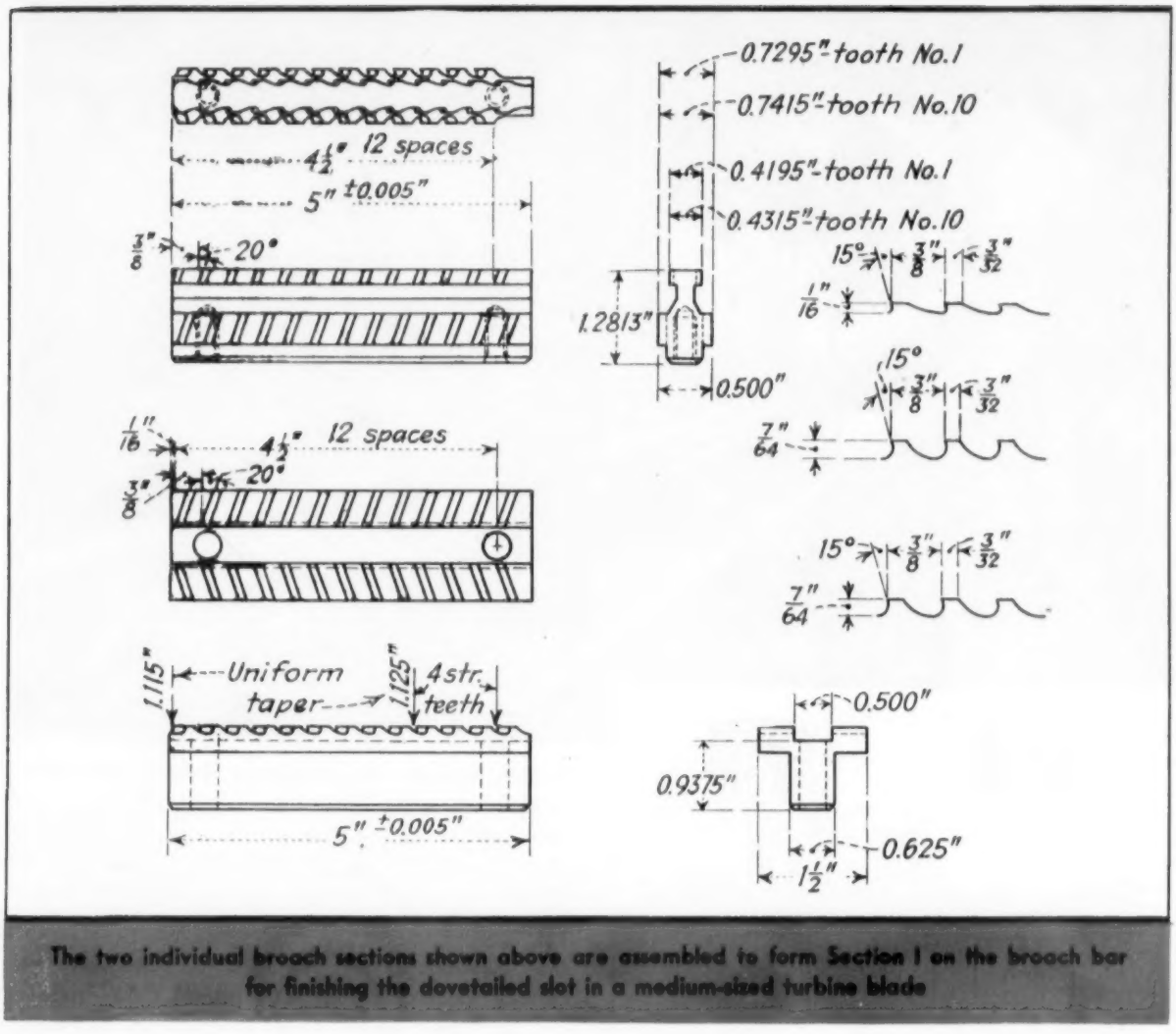
Broach bars for roughing and finishing the dovetailed slots in the blade roots are made up in sections which cut individual surfaces in the slots. Each section is carefully aligned in relation with other sections on the bar

near his work station. In all of the subsequent machining operations on these blanks, the machine operators use standard 10-in. mill cut files to remove burrs produced by the operation performed in his machine. This insures that the blank will fit snugly into the fixture on the next machine, and eliminates cuts which might result from handling pieces having sharp edges.

After the blank has been ground to size, and etched and cleaned, the next group of operations rough and finish the dovetailed slot in the root end of the blade and form the bottom fit. The extent of the broaching operations necessary on the root end depend on the size and shape of the slot. For the blades having one and two dovetail slots, the slot is roughed out in two operations, and then the dovetail form is roughed and finished in one pass of a multiple-section broach. However, for the larger low-pressure blades which have three dovetails in the root slot, six broaching operations are necessary to rough and finish the dovetails and the bottom fit.



Nine different broach sections are assembled on the bar for finishing a double-dovetail slot in a medium-size turbine blade. Some of these sections are made up of two, three or four individual broaches as indicated



The two individual broach sections shown above are assembled to form Section I on the broach bar for finishing the dovetailed slot in a medium-sized turbine blade

For the typical blade shown, only the following operations are necessary:

In Operation 7 the bottom fit is broached to shape and the slot is roughed out to about one-half of its depth. For most of the blades, this slot is in the center of the blade. However, for the blade shown the center line of the slot is about 7/64 in. to one side of the center line of the piece. A different broach section is used to cut each of the different pairs of surfaces. The length of the blank is reduced about 1/64 in. and dimension *A* is held within plus or minus 0.002 in.

The two surfaces indicated at *X* in the sketch for the seventh operation must be in the same plane and perpendicular to the axis of the blank, as these surfaces are used to locate the part in most of the following operations. Dimensions *B*, *D*, and *E* must be held closely, but dimension *C* is not so critical since the slot will be cut away below this line in the next operation.

The fixtures employed for all broaching operations on the root end of the blade blank have stops to locate dimension *A* shown in Operation 7, and have two jaws which move sideways to clamp the edges of the blank. These jaws are moved by screws connected by gears to a rack actuated by an air cylinder. Movement of the piston of this cylinder opens or closes the jaws as required.

Operation 8 consists of rough broaching the balance of the slot in the root end of the blank. For the blade shown, this operation brings the dimension *A* of the slot to a little more than 1¼ in. Finally, in Operation 9, the dovetail slot of this blade blank is finished in one pass of a multiple-section broach bar. An accompanying illustration shows the manner in which this bar is assembled, another shows the outline for each of the nine sections which make up this bar. It will be noted that each section cuts only a part of the form, but when this broach bar has been pulled through the blank the dovetailed slot and the bottom fit are finished.

Shaving teeth had been added on the dovetail broach sections to hold accurately the distance from the bottom of the root form to the bottoms of the dovetail forms. The sketch for Operation 9 shows the tolerances to which these forms must be machined.

In addition to holding the tolerances shown, it is essential that each of the sections which make up the form of the slot be centered on the centerline of the slot. Nine separate width, depth and height gages are furnished for checking double-dovetail slots like that shown. Only six gages are required for checking single-dovetail slots.

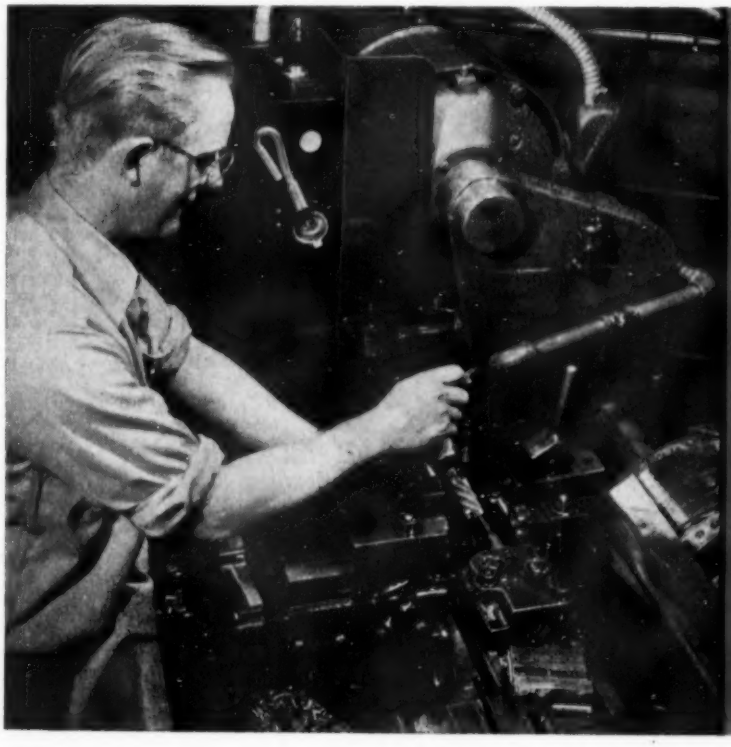
Broaching speeds for operations like those shown in Operations 7, 8 and 9 are about 21 ft. per min. for blanks ½ to ¾ in. thick. For ¾ to 1 in. blanks, broaching speed is reduced to about 17 ft. per min. Broach sections for the dovetail broaches are 5 to 6 in. long and each section usually has 12 teeth ground for uniform stock removal, except on the finish sections where the last four teeth are of the same height. Broach teeth on these sections are spaced ⅜ in. apart, have a 15 deg. lip angle, a 20 deg. rake angle, and a relief angle of 2 deg. for roughing teeth and 1 deg. for finishing teeth.

Broach sections for form broaching operations usually are made of high-speed steel hardened to about 62-64 Rockwell C and then finish ground. The radii which form the tooth shape must be blended together carefully and the entire tooth form must be given a high polish to facilitate movement of chips. For slab broaches, excellent results have been obtained by using Rex Supervan or similar steel hardened to about 64-66 Rockwell C, in place of the usual high-speed steel.

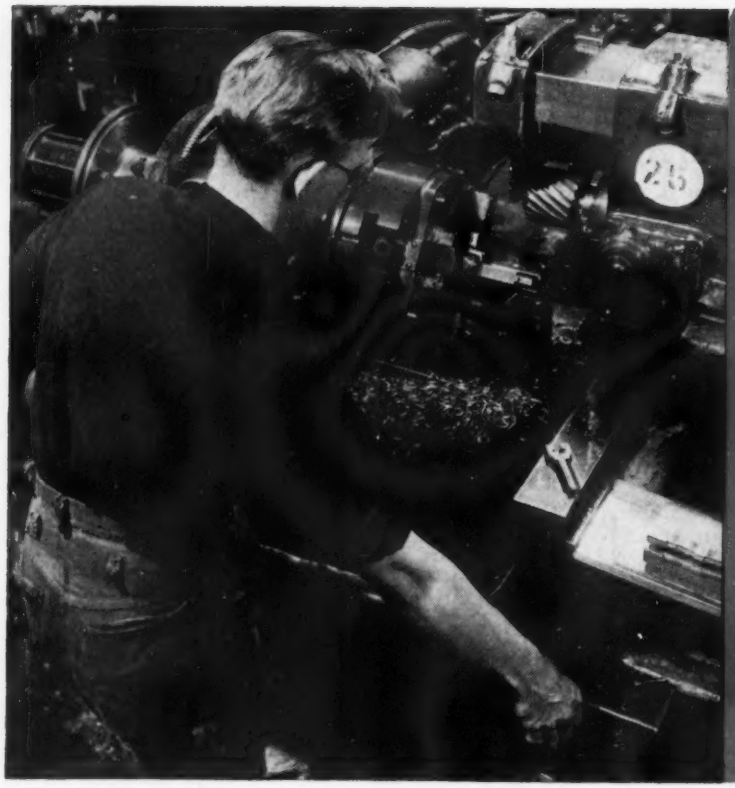
Only three milling operations are required when surface broaching operations are used in the machining of the small and medium size blades. The first of these, which is identified as Operation 10, consists of plunge milling the concave radius in the blade blank. As now set up, this plunge milling operation is done in single-spindle automatic screw machines with work holders on the front and rear cross slides and with a helical cutter held in a collet chuck in the spindle. The cutter shank is keyed for a positive drive in the chuck. The radius *A* shown in the sketch for Operation 10 varies with the blade being machined, so cutters of different diameters and different lengths must be used for the various blades. The front and rear cross slides are fed in toward the cutter simultaneously, so two work pieces are machined at the same time in each cutting cycle.

Cutters Selected to Reduce Chatter

For small and medium size blades, cutter speed is 110 to 115 r.p.m.; this is reduced to 60-65 r.p.m. for the largest blades, which are considerably longer. A slow feed is used to advance the work pieces against the cutter in order to reduce chatter. For the same reason, the cutter blades are irregularly spaced and left-hand helix, right-hand cut flutes are used. Each cutter blade is ground to provide a small rake angle and each has a 1/32 in. land back of the cutting edge. This land is ground with a 6 deg. relief angle and then a back-off clearance is ground at a 14 deg. angle. The cutter is end-milling with chip clearance ground in the ends of the teeth. Originally, 10-tooth cutters were used, but 6-tooth cutters have been substituted



To get production going quickly on Navy turbine blades, single-spindle automatic screw machines were tooled up for plunge milling the concave faces—a type of operation for which these machines seldom are employed. Fixtures for holding blanks were fitted to the front and rear cross-slides and two pieces are milled at the same time



A heavy-duty milling machine equipped with a special rollover fixture having electrical controls and a fluid motor drive is employed for milling the flats and connecting radius which forms the convex rear surface of a turbine spindle blade. The machine cycle is entirely automatic

in order to provide more chip space. Particular care must be used in this plunge milling operation, as this is the only machining operation performed on the concave surface of the blade. The cut must be made to the proper depth, and no scratches can be left in the surface which later cannot be polished out.

For plunge milling the larger blades, a roughing and a finishing cut are taken. These blades are rough milled in a set up on a single-spindle automatic screw machine like that used for smaller blades, and then a finish cut is taken in a knee-type milling machine with the same type of helical cutter. Finishing cutters used in the milling machine for this operation can be reground about five times before the diameter is reduced about 0.010 in., which makes it too small for the finishing cut. The cutter then is used for roughing in the screw machine set-up, where it can be reground about twelve times before the diameter becomes too small for the roughing cut.

When the larger blades were concaved in one cut, only about 350 pieces could be milled per cutter with four to five regrinds during that time. This gave an average life of about 60 to 70 blades per grind. Using two operations for milling the larger blades, about 4,000 pieces can be finish milled with the cutter sharpened about five times, or 800 per grind, and the small-diameter cutter then is used to rough mill about 1,800 pieces with twelve regrinds. Cutter cost per blade is reduced considerably by this practice.

Operation 11 consists of surface broaching the bucket end of the blade to leave a tenon about $\frac{5}{8}$ in. wide and 7/32 in. high extending from that end. This tenon must be centered within 0.002 in. with the centerline of the bucket and must be within plus or minus 0.001 in. of the width *A* shown in the operation sketch. Broach speed for this operation is 32 ft. per min. for blanks up to $\frac{3}{4}$ in. thick, and 24 ft. per min. for thicker blanks. The fixture used for this operation is similar to those employed for broaching operations on the other end of the blank.

Next, the two sides of the blade vane are rough and finish broached in three operations. As shown in the sketches, Operation 12 removes the metal shown at *A* in one cut, then Operations 13 and 14 remove the metal shown at *B* and *C* on the other side of the vane in two cuts. Swinging-leaf fixtures like those used for the first slab broaching operations are employed for these operations. A broaching speed of 21 ft. per min. is used for Operations 12, 13 and 14.

Milling with Rollover Fixture

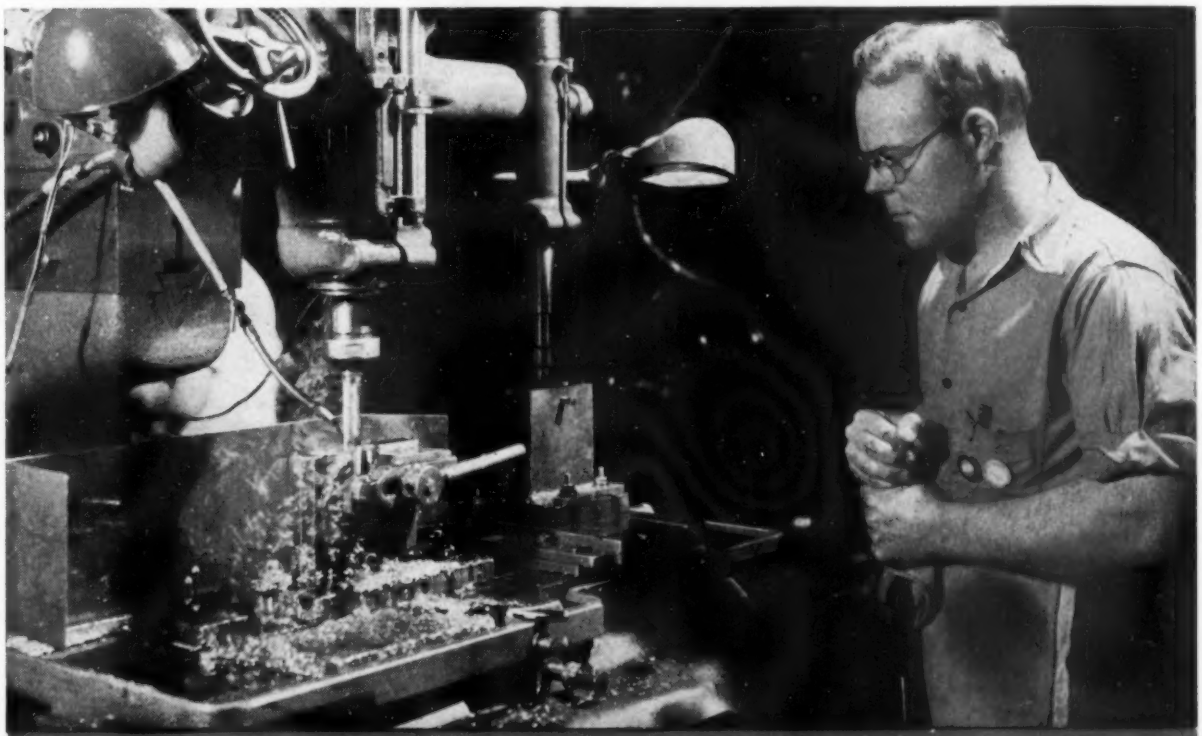
Operation 15 consists of milling the convex surface which forms the back of the blade. This surface consists of two flats tangent to a radius which connects them. The convex form is milled in one cut, using a special milling machine equipped with a "rollover" fixture. The fixture is universal, in that all of the blades made in this department can be machined in the same fixture by adjusting stops on the fixture which control table and fixture feeds and changing the workholder to suit. In the machining cycle for this operation, the table of the milling machine is fed

horizontally a predetermined distance to mill one of the flat sides. Then, automatically, the table movement is stopped and the rollover fixture is rotated by a fluid motor so that the cutter will mill the radius. Fixture rotation then is stopped accurately at a predetermined point and the table feed picks up to mill the other flat side.

A 4-in. diameter cutter is used for all blades, with the length of the helical cutter being selected to suit the length of the blade being milled. Cutters are rotated at 140 r.p.m. for the smaller and shorter blades, and at about 95 r.p.m. for the larger and longer blades. The fluid motor drive for the fixture rotates the fixture head through a worm and worm-wheel drive to provide cutting feeds of ½ to 6 in. min. and a rapid return of about 150 in. per min. when the table of the machine is returned to the starting position. Return of the head is automatic with the return of the table. The fixture is adjustable for radius, angle of contact with the radius and length of blade. Hydraulic circuits of the fixture and fluid motor and the table feed cylinder are interlocked. The work-holding clamp on the fixture is operated by an air cylinder.

In this convex milling operation, the angle *X* must be held within plus or minus 1 deg. while angle *Y* must be held within plus or minus 2 deg. No tolerance is permitted on radius *A* and the thickness of the vane edges at *B* must be within plus or minus 0.002 in. Dimension *C* must be held within plus 0.000 and minus 0.004 in. while dimension *D* must be within plus 0.006 in. and minus 0.000 in. To insure accuracy of operation of the rollover fixtures, precision electric limit switches are adjustably positioned around the periphery of a control circle. Position stops also are provided on the rollover fixture to insure accuracy of location of the two flat sides.

Operation 16 consists of form milling the tenon on the end of the blade in the correct relation to the blade section. This blade, like most of the other blades made in this department, has an oblong tenon with rounded ends on which the length *A* and the width *B* must be within plus 0.000 in. and minus 0.005 in. of the specified dimensions. For the blade shown in the operation sketches, dimension *A* is approximately 19/32 in. while dimension *B* is about ¼ in. and diameter *C* is 7/32 in. Left-hand helix, right-hand cut end mills ranging from 0.627 to 1.017 in. in diameter are used for this operation. These cutters have a 1/32 in. radius on the end. The tapered follower for the profiler matches the diameter of the cutter. The fixture used for this operation is designed to give full support to the blade over its entire length so as to reduce chatter to a minimum.

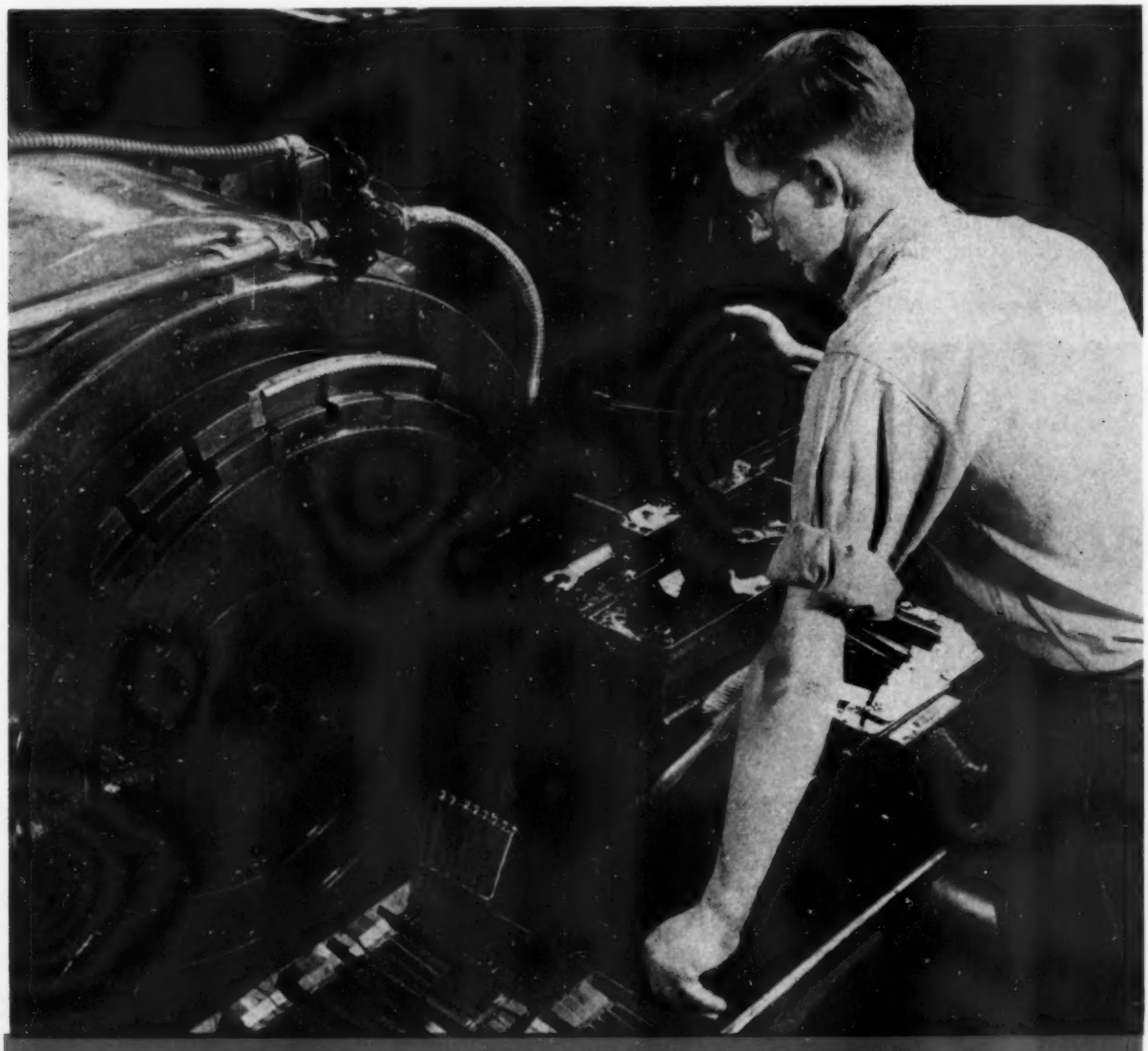


Oblong tenons on the end of turbine blades are form milled one at a time on profilers. Fixtures for this operation are designed to clamp the blade along its entire length

Some of the turbine blades have round tenons. Such tenons are machined in sensitive drill presses, using hollow mills with inserted blades. The fixtures used for this operation are of the same design as those used for the profiling of oblong tenons.

In Operation 17, the root section of the blade is slab broached across one face at a small angle with the centerline of the blade in order to provide a tapered section which will permit the circle of blades to nest together around the periphery of the turbine spindle. In this operation, dimension *A* must be held within plus 0.0005 in. and minus 0.0000 in. Angle *B* for this blade is 2 deg. 24 min. For other blades it is as small as 1 deg. 17 min. 42 sec. This broaching operation is performed at a broaching speed of 24 ft. per min. for blades having a 1 to 1⅜ in. face. For blades having a face width of 1⅜ to 2 in., broaching speed is reduced to 21 ft. per min., and for blades with a face width over 2 in. the speed is 17 ft. per min.

A special rotary broaching machine is employed for Operation 18, which consists of broaching the radial fit for the turbine spindle in the bottom surface of each of the dovetails in the blade slot. This is a critical operation, as it determines the tightness of the fit of the blade on the spindle. As in all of the other broaching operations of these blades, one blade is broached at a time in this rotary machine. Where only one dovetail is provided in the blade root, one broach cutter is mounted on the faceplate of the rotary machine as shown in the accompanying illustration. However, where there are two or three dovetail fits,



The rotary broaching of the bottom surfaces of each dovetail slot is of particular importance as this operation governs the tightness with which the blade fits on the turbine spindle

Final inspection of finished turbine blades is carried out according to a carefully predetermined procedure. Each inspector handles only one operation at a time

two or three cutter blades are fitted to the faceplate on tool blocks like that shown.

In such set-ups, the distances between the broached dovetail faces, such as dimension *B* in the operation sketch, must be held to the specified size. There is no manufacturing tolerance for these dimensions. Other tolerances are shown in the operation sketch. It should be noted that a tolerance of plus or minus 5/8 in. on the cutter radius produces a maximum error of only 0.00005 in. on the work. For this operation, the work is nested in a fixture which locates the work from the straight face at the back of the blade; the blade being clamped in position with a toggle clamp which exerts sufficient pressure to eliminate any possibility of movement of the blade during broaching.

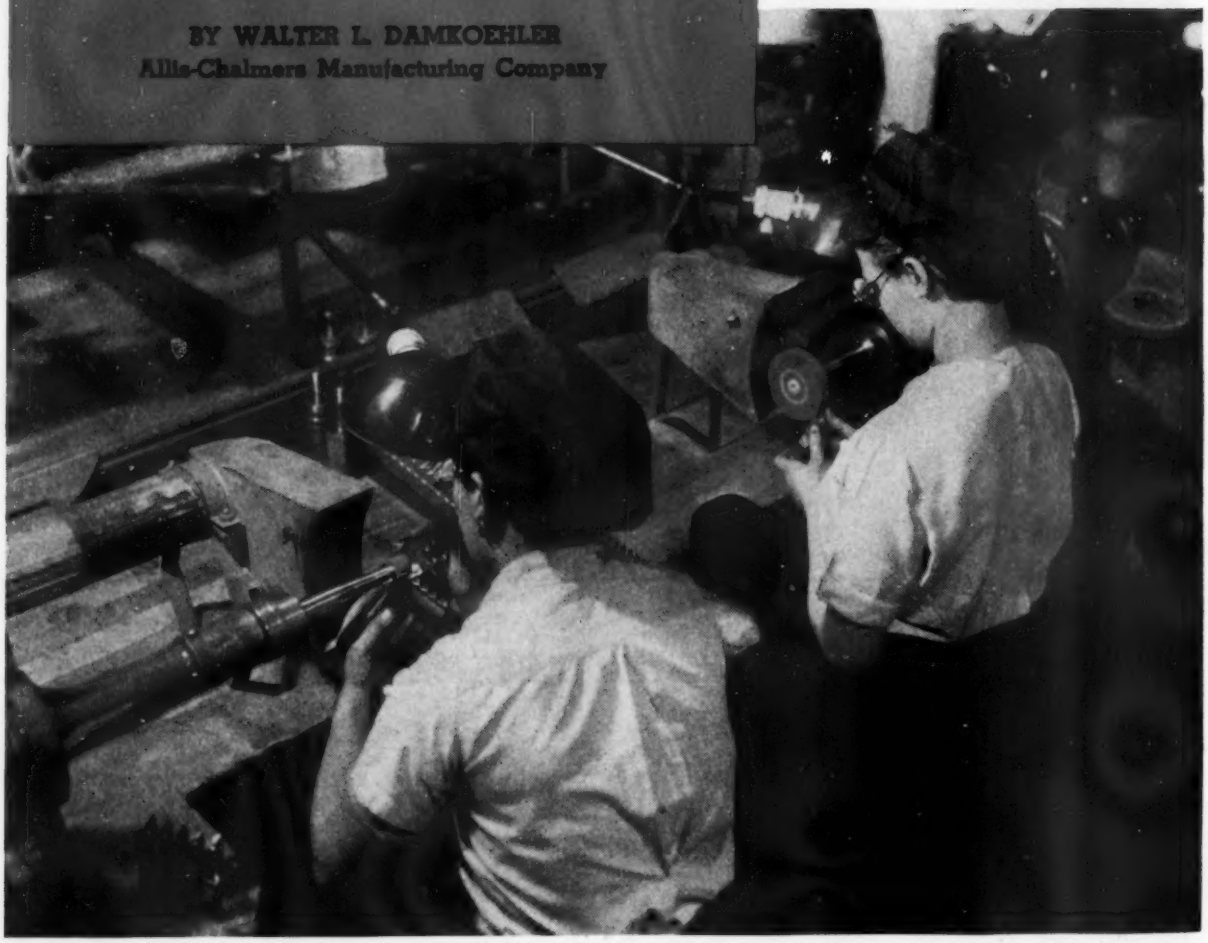
Next, in Operation 19, the taper fit broached in Operation 17 is finish ground on a surface grinder, removing approximately 0.0015 in. of stock from the tapered face of the blade root. As in Operation 17, the thickness *A* must be held within limits of plus 0.0005 in. and minus 0.000 in. A special sine block fixture is used to hold the work for Operation 19. The grinder operator checks each part in a special gage employing a 0.0001 in. indicator. When checking the angle, the indicator readings must be within plus or minus 0.000 in. when the indicator is moved from point *X* to point *Y* on the piece. A tolerance of plus 0.0005 in. and minus 0.000 in. is allowed on the part drawing for dimension *A*. No cumulative tolerance is allowed in the assembly of these blades on the spindle.

The final broaching operation on the blade under discussion consists of cutting a 30-deg. angle on one side of the root section. This Operation 20 is performed in 10-ton horizontal broaching machine using a swing-type fixture like that employed for the first slab broaching operation. A broaching speed of about 21 ft. per min. is employed. This operation is necessary only on those blades in which the dovetail slot originally was broached off center with the centerline of the blank. For the blade under discussion, dimension *A* is held to about 3/16 in., dimension *B* is approximately 1 7/8 in. and angle *C* is 30 deg.

The final operation on each blade consists of finish broaching the bottom fit of the yoke root to fit the spindle. This is done in the blading department using a 3-ton vertical hydraulic broaching press with a push-type broach. The two sections of the broaching cutter are adjusted to suit the dimensions of the spindle when this operation is performed. Dimensions *A* and *B* in the sketch for Operation 24 are cut to suit the spindle by broaching surfaces X.

Polishing Blades For Steam Turbines

BY WALTER L. DAMKOEHLER
Allis-Chalmers Manufacturing Company



Felt and leather bobs, linen buffing wheels and abrasive-impregnated rubber wheels are used for polishing different surfaces on turbine blades. For these operations, the operator sits or stands in a comfortable position close to the wheel. The work bench is cut away so that the operator can get close to the wheel

THE PRODUCTION of a smooth finish without scratches or blemishes of any kind is essential when polishing the bucket-type blades used on the spindles of steam turbines. In fact, a so-called "orange peel" finish is more desirable than the highly reflective bright finish so important on finished commercial articles such as silverware and chrome-plated store fittings.

The polishing of turbine blades is an art that can be learned only after hours of practice. Each operator must develop his own method of producing the required finish. In training polishers for operations on turbine blades, it is important that they be taught to apply correct pressures and to cultivate a careful handling technique when polishing vane edges and radii as too much pressure on these surfaces will result in a damaged blade. It is also essential that their work be spot checked frequently until they have developed the proper technique. Since the blades are relatively small, the small polishing stands are placed on work benches which are cut away in front so that the operator may sit in a convenient position directly in front of the wheel.

Blades are polished in small lots, with each operator completing the polishing of a lot in a day's time; the size of the lot being determined by the number of blades of that particular size and shape that he can finish before the day is done. For the blades made in the department set up to manufacture blades for the U. S. Navy on a special contract, the lot sizes for polishing blades ranges from 20 per day for the larger

sizes to 80 or more a day for the smaller Navy blades.

Turbine blading is polished on the concave and convex surfaces, along the vane edges and at the radius between the end of the vane edge and the root. In normal practice, an operator will rough and finish one surface at a time on a given lot, and then set up for the next surface.

Usually, the concave areas are polished with a felt or leather bob set up with No. 120 aluminum oxide abrasive grit, with the bob diameter selected to suit the radius. Spindle speed of the polishing lathe usually is about 3,450 r.p.m. The concave area is roughed out with a newly set-up wheel and then polished with a wheel which is well broken up. Approximately 0.002 to 0.003 in. of stock is removed in the roughing operation. By drawing the blade sideways in one direction only while polishing with the finishing wheel the operator secures the desired "orange peel" finish, which is preferred because no scratch marks are evident in a close examination of the finished surface.

The convex area at the back of the blade is polished with a 6-in. diameter felt wheel set up with No. 220 aluminum oxide abrasive grit, making sure that this wheel is well "headed." When this wheel is properly conditioned, or broken up, a polish free of grit marks or scratches will be produced. Usually a Class B felt wheel is used for this operation, and it is run at between 2,500 and 3,000 r.p.m. The vane edges and radii are polished with a 4-in. diameter synthetic rubber wheel impregnated with abrasive grit and suitably shaped.

When length is more than 3 in., the blades are polished in a longitudinal direction with rag buffs ranging from 3 to 6 in. in diameter. These wheels are set up with No. 120 to No. 220 aluminum oxide abrasive grit. The rag buffs which have proved most satisfactory are made of linen sections and when well broken up produce a polish free of scratches. These wheels are also desirable because of their fast-cutting action.

The setting up of polishing wheels has been given particular attention in this department and a special bench has been prepared for these operations. This bench consists of a steel cabinet with a wood top on which the operator works when setting up (applying

For precision polishing of turbine blades, the small wheels must be set up carefully by a well-trained operator. The infra-red lamps above this work bench speed drying of recoated wheels

After recoated wheels have been partially dried under infra-red lamps, they are placed in a cabinet for "soaking" at a moderate temperature maintained by incandescent lamps

glue and abrasive grit) the wheels. Above the rear portion of this top surface is a row of six infra-red lamps for drying freshly set up wheels. Ordinarily, a wheel must dry from 8 to 12 hr. in oven drying procedures. With these lamps, the wheels can be used in from 2 to 4 hr. It has been found best not to dry the wheels completely under the infra-red lamps, as this drying is too rapid. Instead, the wheels are placed under the lamps for about 2 hr., and then they are transferred to a cabinet under the bench which is heated with open incandescent lamps. The wheels are allowed to season in this cabinet for at least 2 hr. before use.

Wheels used for polishing turbine blades must be properly dressed before glue or grit is applied. It is especially important that the wheels run true. Hot glue is used only on rag wheels. Cold glue is used on felt wheels and leather bobs. The glue is applied to the small wheels with a hand brush and then the wheel is immediately rolled in a pan of grit on the bench in front of the operator. The wheel must be rolled in this grit with an even pressure so the glue will pick up all of the grit possible and still provide an even coating.

After the wheels have dried properly, the glue and abrasive coating is broken up carefully with a round bar or pipe so that the surface consists of many small, hard sections and the surface conforms to the shape of the wheel.

Wheels must be broken in on the polishing spindle. Fresh wheels are dressed lightly with a piece of carborundum stone, or with a small piece of hardened steel, to break down the sharp edges of the fresh grit. Fresh wheels are used for roughing operations, then as they become properly conditioned they are used for finishing. Often a wheel will be used for two or three months on finishing operations. When a polisher finds a particularly good finishing wheel, he puts it aside for difficult touching up operations. Experience has shown that rag and felt wheels can be used many times if properly dressed and recoated at regular intervals.

Backlash in Gears—I

A standard practice of the American Gear Manufacturers Association, "Inspection and Tolerance for Gears—Part IV."

DEFINITION

In general, backlash in gears is play in the teeth. For purposes of measurement and calculation, backlash is defined as the amount by which a tooth space exceeds the thickness of an engaging tooth. When not otherwise specified, numerical values of backlash are understood to be given on the pitch circles.

The purpose of backlash is to prevent gears from jamming together and making contact on both sides of their teeth simultaneously.

Lack of backlash may cause noise, overloading and overheating of the gears and bearings, even seizing and failure.

Excessive backlash is objectionable, particularly if the drive is frequently reversing, or if there is an over-running load as in cam drives.

Specification of unnecessarily close backlash increases the cost of gears, because errors in runout, pitch, profile, and mounting must be held correspondingly closer.

On the other hand, provision of reasonable backlash permits greater leeway in manufacturing, and usually is not detrimental to proper gear action.

PROPER BACKLASH

In setting up proper backlash amounts and tolerances for a pair of gears, many factors should be considered. The most important factor is probably the maximum amount of runout expected in both gear and pinion (or worm). Next are errors in profile, pitch, tooth thickness and helix angle. Tolerances for spur and helical gears have been published; also tolerances for worms and worm gears and for bevel and hypoid gears. Obviously the backlash between a pair of gears will vary as successive teeth make contact, because of the effect of tooth errors, particularly runout.

Other important considerations are speed, space for lubricant film, and room for trapped oil to escape as the teeth pass through mesh. Slow-moving gears in general require the least backlash, although the lubricant may be a heavy oil or grease. Fast-moving gears are usually lubricated with relatively light oil, but if there is insufficient clearance for an oil film, and particularly for oil trapped at the root of the teeth to escape, heat and excessive tooth loading will occur. At any given speed, trapping of the oil is not as much of a problem with helical gears as with wide-faced spur gears, because the gradual meshing of the teeth gives the oil an opportunity to escape. When helical gears are operated at extremely high speeds, the time for oil to escape may be extremely short, requiring careful regulation of oil directed into the teeth.

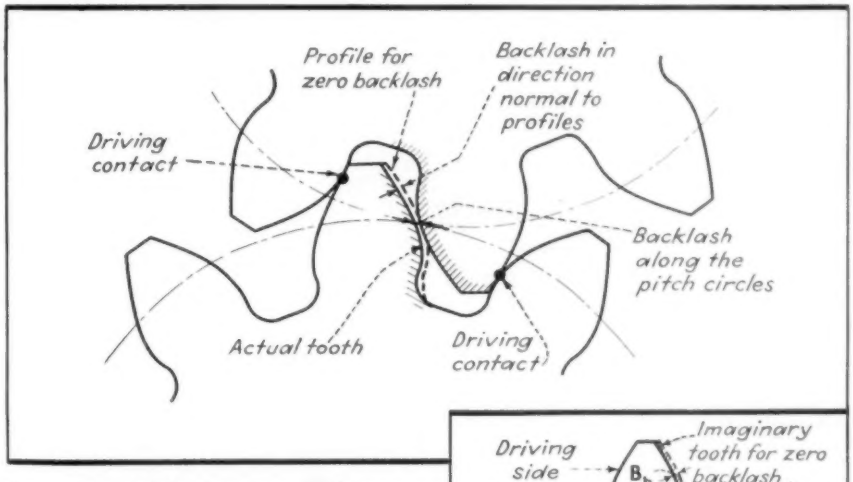


Fig. 1—Backlash between tooth profiles of gears

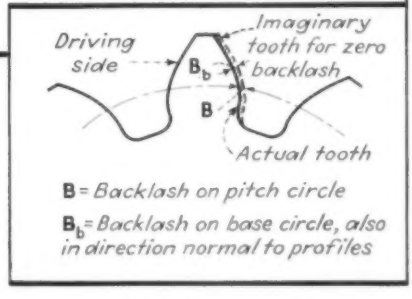

Driving side
B_b
Imaginary tooth for zero backlash
B
Actual tooth
B = Backlash on pitch circle
B_b = Backlash on base circle, also in direction normal to profiles

Fig. 2—Backlash in transverse plane

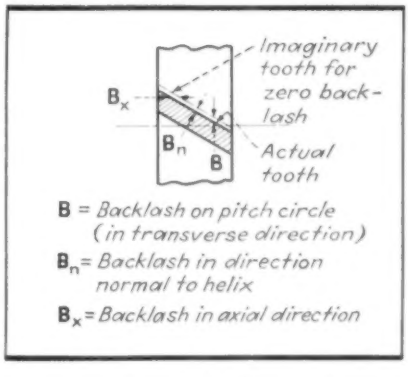

B_x
Imaginary tooth for zero backlash
B_n
B
Actual tooth
B = Backlash on pitch circle (in transverse direction)
B_n = Backlash in direction normal to helix
B_x = Backlash in axial direction

Fig. 3—Backlash in pitch plane

Heat is a factor because gears may operate warmer, and expand more, than the housings. The heat may result from oil churning, from frictional losses between the teeth, bearings or oil seals, or from external causes. Moreover, the gear material —for example, bronze—may expand more than the material of the housings for the same temperature rise.

The higher the helix angle or spiral angle, the more transverse backlash is required for a given normal backlash. The transverse backlash multiplied by the cosine of the helix angle gives the normal backlash. For higher pressure angles, more backlash is required on the pitch circles to obtain a given amount of backlash in a direction normal to the tooth profiles.

Errors in boring the gear housings, both in center distance and misalignment, are of extreme importance in establishing backlash tolerances. The same is true in the mounting of the gears, which is affected by the type and adjustment of bearings.

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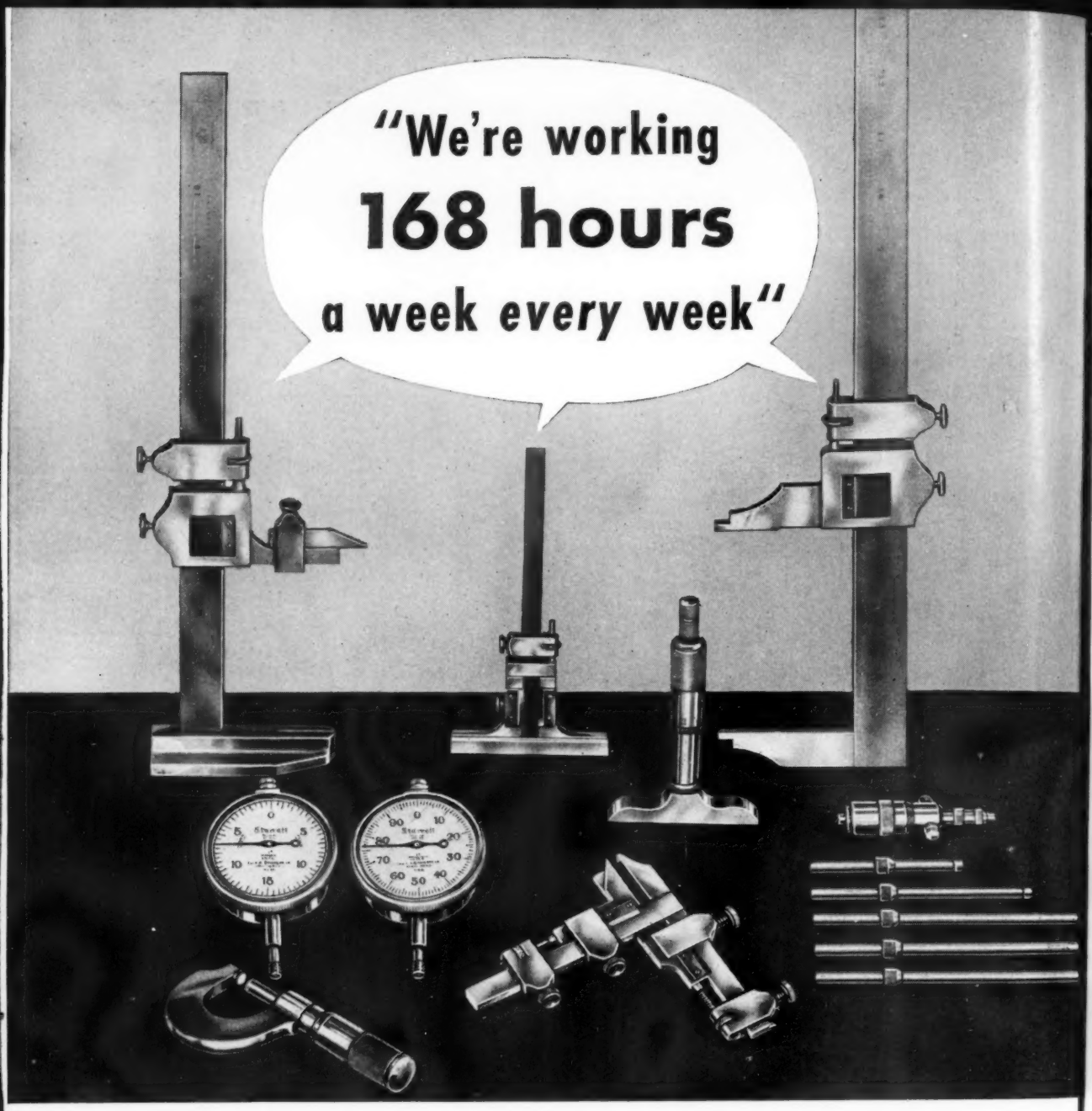

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Backlash in Gears—II

Other influences in backlash specification are heat-treatment subsequent to cutting the teeth, lapping operations, the possible necessity for recut for any reason, and reduction of tooth thickness from normal wear.

Minimum backlash is necessary for timing, indexing, gunsighting, and certain instrument trains. If the operating speed is nil and the necessary precautions taken in the manufacture of such gearing trains, the backlash may be held to extremely small limits. However, the specification of "zero backlash," so commonly stipulated for gears of this nature, usually involves special and expensive technique, and is difficult to obtain.

PROVIDING BACKLASH

It is customary to make half of the allowance for backlash on the tooth thickness of each gear of a pair, although there are exceptions. For example, on pinions with low numbers of teeth it is desirable to provide all of the allowance on the mating gear, so as not to weaken the pinion teeth. In worm gearing ordinary practice is to provide all of the allowance on the worm which is usually made of a stronger material than the worm gear.

In spur and helical gearing, backlash allowance is usually obtained by sinking the cutter deeper into the blank than the theoretically standard depth. In some instances the allowance is provided in the cutter instead, and the cutter is then operated at the standard tooth depth. In other cases, backlash is obtained by setting the distance between two tools for cutting the two sides to the teeth, as in straight bevel gears, or by taking side cuts, or by changing the center distance between the gears.

CONTROL OF BACKLASH

Provision is often made for adjusting one gear relative to the other, thereby affording control over backlash at assembly, and throughout life of the gears. Such practice is most common in bevel gearing. It is fairly common in spur and helical gearing when the application permits slight changes between shaft centers. It is practical in worm gearing only for single-thread worms with low lead angles, otherwise faulty contact results.

Service adjustment of backlash is practical only if the amount of gear wear is slight. Otherwise, closer meshing will result in the tops of teeth of one gear interfering with unworn portions of flanks on the mating teeth. For this reason other methods of controlling backlash are preferable when backlash must be held to a minimum throughout the life of the gears. For example, in printing machinery the backlash between certain spur gears is adjustable by making one gear of each pair in two sections adjustably bolted together.

MEASUREMENT

Backlash is commonly measured by holding one gear of a pair stationary, and rocking the other back and forth. The movement is registered by a dial indicator having its pointer or finger in a plane of rotation at or near the pitch diameter and in a direction parallel to a tangent to the pitch circle of the moving gear.

If the direction of measurement is normal to the teeth, or other than as specified above, it is recommended that readings be converted to the plane of rotation and in a tangent direction, for purposes of standardization and comparison.

In spur gears, parallel helical gears and bevel gears, it is immaterial whether the pinion or gear is held stationary for the test. In crossed helical, worm and hypoid gears, readings may vary according to which member is stationary; hence, it is customary to hold the pinion or worm stationary, and measure on the gear.

In some instances backlash is measured by thickness gages or feelers. A similar method utilizes lead wire inserted between the teeth as they pass through mesh. In both cases it is likewise recommended that readings be converted, taking into account the normal pressure angle, and the helix angle or spiral angle of the teeth.

Another method consists of meshing a pair of gears tightly together on centers and observing the variation from the specified center distance. Such readings should also be converted for the reasons previously given.

Backlash measurements may vary on the same pair of gears, depending upon whether they are mounted in theoretically correct relative positions, or assembled ready for running. Likewise there will usually be a substantial difference between the maximum and minimum at different points around the gears.

RECOMMENDED BACKLASH

The following tables of backlash assume average conditions for general purpose gearing. In many instances these limits require modification for the many reasons heretofore stated, and it is therefore emphasized that judgment must be used in their application. Tolerances for pitches other than those listed may be obtained by interpolation.

The tables are given for gears assembled on standard or specified center distance.

TABLE A

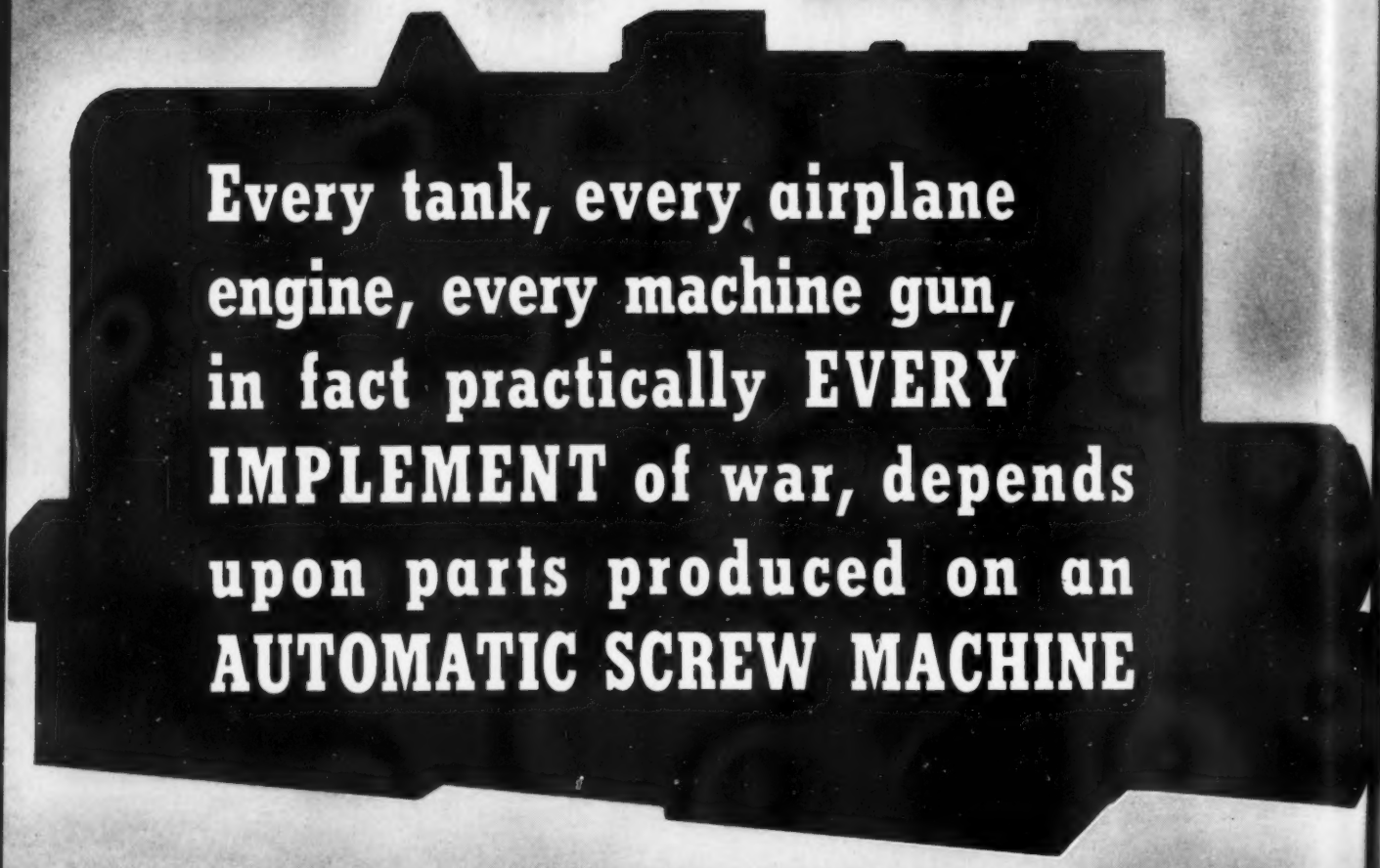
Spur Gears, Parallel and Crossed Helical Gears, Straight, Spiral, and Zerol Bevel Gears, Hypoid Gears

D.P.	BACKLASH
1	0.025-0.040
2	0.014-0.020
4	0.007-0.011
8	0.004-0.006
16	0.002-0.004
32	0.002-0.004

TABLE B

Worm Gears

C.P.	BACKLASH
4	0.032-0.050
2	0.017-0.025
1	0.009-0.014
½	0.005-0.007
¼	0.003-0.005
⅛	0.002-0.004



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An Open Letter to Harold Ickes

Dear Mr. Ickes:

Many of us have suspected for some time that certain people in Washington have been waiting for an opportune moment to reopen a barrage against industry. Since more than once you have been the spearhead in such attacks, it was not surprising to open our favorite newspaper the other morning and read your remarks that if the war effort on the home front is not going so well as it should, no one but business men are to blame, for they have been in charge.

Just how you figure that out puzzles me. You yourself have long had the responsibility for a considerable segment of the home front; and surely you would not classify yourself along with the dollar-a-year men. Many other men who have not stepped out of the ranks of business or industry are in command of various divisions along the home front—Justice Byrnes, Prentiss Brown, Marvin Jones, Judge Vinson, to mention only a few.

Then there are a number of generals not assigned to specific sectors but with roving duties who would hardly qualify as business men. If you want names, we might cite Harry Hopkins, Judge Rosenman, Ben Cohen and Wayne Coy. From what I have read in the newspapers, I should say that they have a good deal to do with molding and carrying out the policies on the home front.

Since you were the one that brought up the subject of dollar-a-year men and they have been associated mostly with war production rather than with other phases of the war program, perhaps it isn't out of order to say a few words about what industry has done under their guidance.

It is hardly news to you that a production miracle the like of which the world has never before seen has taken place in America the past few years. As the end of our second year of direct participation in the war draws near, our production of war goods is of a magnitude that Hitler and Tojo didn't think possible, otherwise they would not have tempted fate by challenging us to make such an effort.

Our factories today are pouring out guns and planes and ships and a thousand instruments of war at a rate far exceeding our entire national output in any year in the fabulous twenties. The war output of the automotive industry alone is so enormous that out of its factory doors come war products equivalent to the building within the short space of twelve months of two-thirds of all the motor cars and trucks owned in this country.

Starting almost from scratch, the shipbuilding industry has worked night and day expanding its facilities and rehabilitating old yards and straining to get out more production to the point where every two and a half days merchant ship tonnage equal in size to building the *Normandie* is turned out.

In the spring of 1940 the shortage of explosive-making capacity in this country gave our top military men many sleepless nights. Thanks to what industry has done since then, we have available enough facilities to make all the explosives required by all the armies of the world.

Japan felt that to deprive us of rubber would be to cripple us. But her leaders failed to reckon with our industrial resourcefulness. We began from zero and almost within a year's time the biggest chemical business in history was created. Before the end of next year there will be no rubber problem in the United States.

We were desperately short of certain critical raw materials. But the story today is different. We have enough aluminum for our mammoth plane-building program. We have so much magnesium that it is "sticking out of our ears." In the last three years we have constructed new steel capacity in this country equal to building a new industry two-thirds the size of Britain's steel industry.

Altogether our war industries are producing more war goods of all kinds than all the other nations in the world combined. And that goes for airplanes too. Quite in contrast, I should say, with our puny, almost non-existent manufacture of war goods only three years ago.

Not a bad record, Mr. Ickes. If you wish to put the blame for it squarely on the shoulders of industry, that is all right with us because that is where it belongs. If other sectors along the home front had made such a record, our affairs at home would be in far better shape than they are.

Sincerely,

Burnham Finney

Gaging Business

War output rising from plateau of last three months. Peak plane production is not expected until next January. Shipbuilding is on schedule, reaching top this month. The machine tool order backlog is shrinking as orders drop.

War production is rising once again. With the armed services and WPB putting on the heat, output is coming off the plateau upon which it has stayed since May 1. Aircraft assemblies in particular are up. The July total may not have been 8000, but came close to it. Aircraft, because of its huge program, still is the biggest headache. Peak plane production will not come until next January, perhaps March.

Numerous factors in addition to over-confidence brought about the recent lag. They were 1) local manpower difficulties, 2) plane design changes that interfered with production, 3) coal strike that hurt steel, 4) cutbacks that made workers slacken their efforts, and 5) tendency to pause after feverish 18 months.

Only a miracle will permit accomplishment of the 1943 plane schedule. That is not discouraging, because the goal was put at an impossible height. Actual output will be way above anything ever built here or anywhere else. Aircraft production now is well over 40 percent of all war production and is still climbing.

Ships are being delivered on time or ahead of schedule. Supply of steel at yards is good. Manpower is chief limiting factor in shipbuilding. This month the top rate of constructing ships will be reached and the curve will level off, but no decrease is expected in the next 12 months.

No new shipyards are contemplated. Should new facilities be needed, and that appears unlikely, they would be placed in existing yards. Working force in one West Coast yard consists of 20 percent women. About 10 percent of merchant ship tonnage today is being built by inland yards. First Victory ship, having higher speed than Liberties, is not to be ready until the middle of '44.

Though overall war production continues up, cutbacks have caused many serious dislocations. Cancellations already made of war contracts equal those at the end of the last war.

Reconversion of plants making ordnance has been on a large scale. Several companies heretofore building tanks have virtually stopped production of that item and are devoting full attention to their normal task of making locomotives and cars badly needed in this country and for military purposes abroad.

R. Hoe & Co. is an example of reconversion. Its rate of making 90-mm. recoil mechanisms was slashed in half and added business was taken on in plane and engine parts and in gun mounts. Koppers, Inc., Baltimore, has gone over to making marine engines, which have been a bottleneck. Bridgewater Mfg. Co., having lost ordnance orders, found it could make struts for Army transport planes.

Machine tool backlog has shrunk to about half a billion dollars. Net orders in June were $38,322,000. They are believed to have been less in July. Production has continued about $100,000,000 a month.

Machine tool business will continue to slide off and by the final quarter output will fall sharply. WPB is cutting materials allotments to machine tool builders. Russia is expected to place new orders later on. Shipments to her in the current fiscal year should be $125,000,000 of machine tools, or perhaps more.

Living Costs and Union Rivalry: Labor Unrest

Labor becomes more active in its demands for abrogation of the Little Steel formula or a cost of living rollback; leaders will compete to "deliver the goods"

NEW YORK—Summer's dog days have brought no doldrums to the labor front. All along the line increasing tension, open conflicts, and a jockeying for position among the competing union groups promise to make '43's third quarter critical in union-management relations.

First, and most important, is the gathering assault—which finds every labor group acting in concert—against the economic stabilization program. Organized labor maintains, with a measure of justice, that nothing in the economy has been stabilized as effectively as wage rates. The National War Labor Board's rigid adherence to the Little Steel formula, which limits wage increases to 15 percent above the January, 1941, wage base, has put a ceiling on hourly earnings while the cost of living—now more than 25 percent above January, 1941—keeps on inching up. To be sure, upgrading, overtime, and the movement of wage earners from the lower paid non-essential industries into higher paid war industries have kept the average weekly take-home pay in step with mounting living costs. But the unions, like industry, are primarily interested in the hourly wage figure which is written into a collective bargaining agreement. And it is this figure which has been pretty well frozen.

Again Demand Rollback

For the nth time now, union leaders have demanded that the Administration roll back the cost of living to September, 1942, levels, the date when prices were at the point where they equated the increases permitted by Little Steel. They threaten, vaguely, desperate action unless this patently impossible is done. To be sure, they will be satisfied with much less than a 10 percent price rollback, but some kind of token action they must have.

For the demand to arrest the upward price spiral is not something that union bosses dreamed up in a smoke-filled room. On the contrary, they know how unpopular such demands can make them in wartime and if it were possible to go along quietly without making a fuss they would certainly do so. But there is a rank-and-file pressure on union officialdom which is irresistible. If the leaders do not get some results on the price or wage issue, the membership will get out of hand.

Strikes Before Autumn

Consequently the rising labor chorus to roll back prices or open the stabilization gates to permit wage boosts will grow more shrill. And it will not be confined to oratory. Organized labor is convinced it must break the Little Steel formula or lose more ground than it is prepared to sacrifice. If conferences at the White House, political action at home, and fiery speeches don't accomplish the result, look for strikes and picket lines on a broad scale before the summer is over. Peace on the labor front hangs by a thread.

Plan Own Political Front

Meanwhile the unions are girding themselves to play a bigger and more direct role in politics than they have attempted before. Up to now, labor depended on the Administration to protect its gains and advance its interests. When Congress overrode the President's veto and passed the Connally-Smith anti-strike law, the unions saw that the Administration could be a very thin reed. Therefore, with increasing concentration, they are turning their attention toward political organization which will give them the power to influence Congress. Most union treasuries are hog-fat, with dues coming in in torrents and little or nothing going out to finance strikes, and a big slice will be spent for political activities.

How close together the A.F.L. and C.I.O. will be able to get on a political program remains to be seen. They have fundamental differences over such issues as the administration of the Wagner Act. Nevertheless, whether they work together or apart, the energies and money they will expend cannot fail to make them a more significant force than they have been.

Would Lead A.F.L.

All these developments go on against a background in which an intense struggle for power in the labor movement is being fought out. The large shadow of John L. Lewis is now cast over the A.F.L. and the implications of his imminent return to the Federation are far reaching. Lewis comes back to the organization he left in 1936 because he thinks the time is ripe for him to make a successful bid for leadership of the A.F.L. He is sure that the brand of militancy he represents will shortly be proved to be the correct strategy for labor. He counts on the unions getting nothing more from the New Deal than they are able to take.

In the end, however, it is clear that whether Lewis or his rivals come out on top, the victory will go to the faction which can show that it can best deliver the goods—which in this case happens to be higher wages. Therefore the internal competition in the labor movement will see each ambitious rival trying to outdo the others.

Milestone—Brig. Gen. J. K. Christmas congratulates E. J. Hunt, operating manager, Chrysler Tank Arsenal, for completing the 10,000th Chrysler-built tank. With General Christmas is Brig. Gen. W. P. Boatwright, commanding officer, Detroit Tank Automotive Center.

Brazil Bound—Before leaving for Brazil to consult on rebuilding machine tools there, and to inspect U. S. Navy bases in an advisory capacity, Charles A. Simmons, Sr., president, Simmons Machine Tool Corp., was given a dinner by Bureau of Ships associates, where he was chief of Available Tools Section. Shaking hands with him is Capt. E. R. Henning, Army-Navy Munitions Board, and Capt. L. F. Small, asst. head, Shipbuilding Division

Brazil Develops Industry in Preparing a Balanced Economy

WASHINGTON—A new outlook on international relations, together with new techniques of industrial economy, has laid a firm foundation for developing the latent but vast natural resources for Brazil, according to the Office of the Coordinator of Inter-American Affairs.

The major industrial project now under construction in Brazil is the National Steel Mill, located at Volta Redonda, about 90 miles from Rio de Janeiro and 220 miles from Sao Paulo. The plant is expected to produce 300,000 tons of steel and 50,000 tons of pig iron annually, which would amount to about half of Brazil's past annual steel requirements. It will produce as by-products sulfate of ammonia, toluol, benzol, heavy and light oils, tar, and basic products for chemical industries.

Materials from U. S.

The United States is at present providing the Volta Redonda steel plant with materials for constructing the blast furnaces, coke ovens, open-hearth furnaces, and rolling mills, along with other equipment.

Brazil's industrial expansion will be further augmented by a $14,000,000 credit provided by the United States and repayable in 25 years, for the purpose of exploiting the high-grade iron ore of the Itabira mines, believed to constitute the world's largest single deposit of iron. From this source the United States and British steel industries will be provided with high-grade iron ores. Brazilian reserves will be the largest source of iron available to the United Nations to offset the loss to the Axis of high-grade ores in Sweden, France and the U.S.S.R.

Will Aid Brazil's Growth

Some of the Itabira ore is also expected to be used for Brazil's own future steel requirements. The shipping shortage in particular has made it urgent that Brazil increase its self-sufficiency in such basic items as steel so that the country may proceed with the development of its gigantic resources of raw materials.

Munitions Industry Grew

Since 1930 the Brazilian government has remodeled, enlarged, and re-equipped its munitions industries. The results of these activities are exemplified by the arsenal in Rio de Janeiro, which today is two and one-half times as large as, and more efficient than, formerly. Other munitions industries throughout Brazil show proportionate improvement.

Prepare for Air Age

Considering the rugged topography in Brazil, the importance that air transport will play in its future is apparent. Brazil began to organize and develop its own aircraft manufacturing industry in 1935. Since then scores of planes have been built by the Fabrica Brasiletra de Avioes in Rio de Janeiro. These planes are used in Brazil's military air forces. A modern forward stride in Brazil's air power is the erection of an airplane motor plant, now being built near Rio de Janerio. The government has obtained a license to build Wright Whirlwind motors at this plant. The buildings, with 180,000 sq. ft. of floor space, will include a machine shop, factory offices, a foundry, a heat-treating plant, eight soundproof test cells, and a reception center with a clinic for the 500 workers and their families. A modern worker community will be built near the plant.

Broad Implications

Brazil is expected to emerge from the war period with a better balanced economy, stronger industry, and will perhaps be somewhat less dependent upon foreign countries as a buyer and seller. With industrialization and economic diversification progressing rapidly, Brazil's domestic self-sufficiency is increasing. Its industrial production is constantly gaining in relation to its agricultural economy. Brazil still has an enormous field ahead for industrial expansion. The nation hopes to reach a phase of balanced economic progress, thus breaking away from the condition of relative dependency built around an economy of exclusive production of war materials and foodstuffs.

Teaches Belt Splicing

EAST PITTSBURGH—As a contribution to the war production program, the Westinghouse Electric & Mfg. Co. has opened a school to teach men from other industries the secrets of a cotton belt splicing technique that has already saved thousands of dollars worth of time and materials in the construction of war equipment. The use of the technique in Westinghouse plants, officials said, has increased the efficiency of machinery and released war-scarce leather and rubber for other uses. It cuts down sharply the time machines are idle for belting repairs, and resulted in savings of $12,000 the first year of its operation. Even greater savings have been realized since.

Method Offered Free

The patented method, developed by a veteran Westinghouse workman, is being offered without charge to other companies for the duration of the war, in line with a request of the Army's Bureau of Ordnance which sought "not only new developments but ideas already reduced to practice that we can pass on to others doing similar work."

SIMPLIFY REVIEW PROCEDURES

WASHINGTON — Requirements for the review of purchase orders for machine tools and capital equipment are restricted to those cases where the items included in the purchase order were not listed in the certificate which assigned the preference rating. This is part of Directive 23, issued by the War Production Board as part of a move to simplify procedures for purchases by government agencies.

Inside Detroit

The need for heavy duty trucks, coupled with idleness of tank-building facilities, may result in production for civilian transport. Industry is troubled with filling the lower-paid jobs: foundry production is lagging behind as a result

BY SILER FREEMAN

Would Turn To Trucks

The increasing seriousness of the motor transport situation throughout the country may bring the solution to the problem of what to do with the unused tank building facilities. Because of the heavy cutbacks in tank contracts, the idle facilities have caused concern.

But R. L. Vaniman, chief of the automotive section of the War Production Board has come up with the proposal that the facilities be turned over to turning out heavy duty truck components in which there are a number of bottlenecks at present. Whether his suggestion will be taken up is another thing.

Vaniman is seeking materials and facilities to build 50,000 heavy and 30,000 medium trucks for 1944. This is the minimum which the Office of Defense Transportation has set for the coming year to keep the essential civilian motor transport in operation.

Facilities Are The Problem

Vaniman frankly admits that he does not expect the full number in either category. But surprisingly, the drawback is not lack of materials but lack of idle facilities which would build them without interfering with war production.

The automotive chief of the WPB does not admit that civilian transportation should take a back seat for military products.

"When you consider that between 60 and 70 percent of all goods brought in and taken out of war plants come on tires, anyone will acknowledge that the transport problem is as important as war production," he said.

But Vaniman admits that 1944 looms as a big year for demands on all plants. Military and lend-lease will be the heaviest in history.

Study Parts Situation

Another problem confronting the section of the WPB is the parts situation. It is receiving a lot of attention, he said, and the parts industry has been studying solution to shortages.

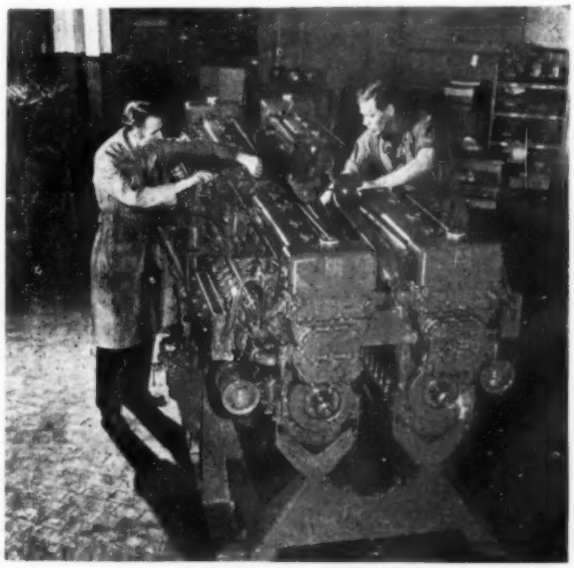
Here again facilities, rather than materials, are the bottleneck, according to Vaniman. Where his section has found materials holding up essential parts manufacture, it has taken special steps to supply the parts maker, he said.

The principal shortages are in axles, transmissions, and certain engine parts, gears mainly. June, however, was better than May, he said, and the next 90 to 120 days should see a big improvement in the situation.

The Pressure Is Reversed

The war has brought about strange things but one of the strongest is the changing manpower picture. At one time, the industrialists were worrying how fast they could upgrade men and women from unskilled to semi-skilled jobs.

Now it is just the opposite. The manufacturers would like to downgrade some of their semi-skilled help to fill the gaps in the lower ranks. They have found they can train men and women quickly to operate the foolproof equipment they installed to turn out war products. But jobs in the lower brackets go unfilled because no one wants them.



Four on a Shaft— A new technique of engine combination, by which horsepower delivery to a single propeller shaft is increased 4-fold with important savings in weight and space, has been developed by Diesel Engine Div., General Motors Corp. The "Quad," four standard 6-cylinder 2-cycle engines, geared to a common shaft, occupies less space, drives U. S. Navy landing barges with more cruising range

This is now especially true in the foundry labor situation. The district War Manpower Commission has been tearing its collective hair to find some way to get enough unskilled labor to keep the foundries going full blast.

The automotive industry has always been the biggest customers of the foundries. Grey iron, malleable or aluminum, the demand has grown by leaps and bounds. And 90 to 95 percent of the labor in the foundries is classified as unskilled.

With lots of reason, foundry workers have been quitting 93-cent an hour jobs to take machine operating jobs at $1.03 to $1.13 an hour plus overtime. The foundries have been unable to find replacements for them and are now demanding that the WMC do something about the situation.

Labor Turnover Raises Rejects

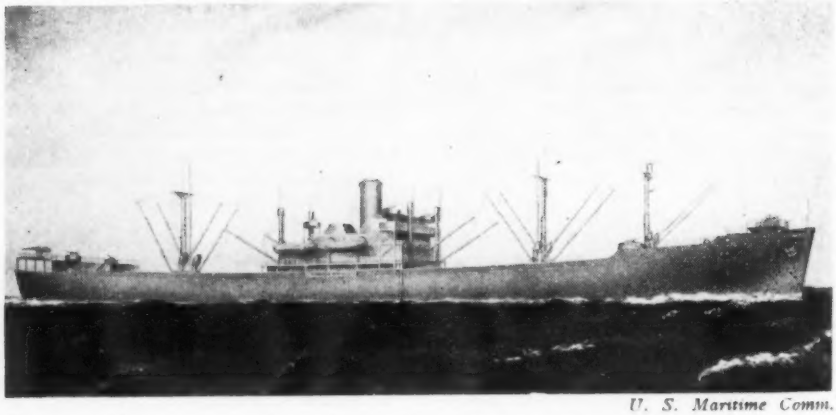
A large Cleveland foundry is reported about six months behind orders. Every war plant is using castings and with the type of help that the foundries have been able to fill in with, the plants are getting more than the usual run of faulty castings. The rapid turnover in labor has brought rejects to 60 to 70 percent.

To illustrate the turnover in foundry labor, a small Detroit plant with a normal peak employment of 200 workers has hired 495 in the last three months without once reaching the peak.

The WMC here is now working with the foundry men to find a solution. The Detroit Ordnance District has also had representatives at the conferences on the shortage. It was proposed to recruit Mexicans to fill the unskilled jobs.

WMC figures here show that the Detroit area can absorb at least 1,500 unskilled workers at the present time. Muskegon can use another 1,000 and Pontiac has jobs for 500. Flint is the only war production center whose unskilled labor situation can be termed "easy."

Plan Gradual Shift from Liberty To Victory Ships; Output Down



U. S. Maritime Comm.

The new Victory type ship, designed by the Maritime Commission as an improvement of the Liberty ship, will be a faster vessel, with finer hull lines and equipped with turbine-gear propulsion machinery of more than twice the horsepower of the Liberty's reciprocating steam engines. Designed for a speed of 15 knots or more, as compared with the 11 knots of the Liberty ships, its deadweight will be about the same: 10,800 tons

WASHINGTON — There will be no abrupt shift from production of Liberty ships to that of Victory bottoms, according to Rear Admiral Howard L. Vickery, vice chairman, U. S. Maritime Commission.

Instead, said Admiral Vickery, after the laying of the first Victory keel in December, Liberty production will be tapered off as rapidly as conversion of facilities can be made and components for the Victorys become available.

To Carry Equal Cargo

About 300 Victory ships are expected to be produced in 1944, with the first one coming off the ways in February, and the rate of production increasing as the year goes on. By 1945, the Admiral expects production of 85 or 90 of these speedy freighters per month. This compares favorably with present production of 115 Liberty ships per month, for over a long period, 90 of the faster Victorys can haul as much cargo as 123 of the Libertys.

Will They Retire Liberties?

No one in Maritime Commission will comment on the possibility of Liberty ships being tied up as increased numbers of the faster Victorys become available. However, there is no doubt in the minds of observers that this will happen. Designed to make 15 knots or better, as compared to the 11-plus knots of the Liberty ships, and yet carry the same deadweight tonnage, each Victory ship can, in a year, haul roughly one-third more freight. They may attain even great efficiency through being fast enough to elude submarines without having to plod along in shielded convoys, gaiting their speed to that of the slowest freighter in the group.

Less Distance Cuts Strain

Asked about the increased productivity of ships in service, due to the opening of the Mediterranean, Admiral Vickery pointed out that it coincides with the need for supplying increasingly larger expeditionary forces. However, there is no gainsaying the fact that the institution of the open door policy across "Mare Nostrum," has eased the strain of supplying Allied troops in that theatre.

Heat, Steel Cut Production

The June heat wave cheated us of the production of 12 ships, due to welders being unable to work, having to be sent home to escape the unbearable temperatures.

Ship production is short a volume of steel almost equal to the total estimated national loss of 300,000 tons resulting from the coal strike.

Helicopters Come Slowly

In reply to a question, the Admiral said that helicopter landing platforms are not being added to merchant ships as standard construction. Such a platform was placed on one ship as an experiment, and the helicopter gave satisfactory performance at sea, even in fairly stormy weather. But the addition of platforms is necessarily paced by the production of helicopters, he said.

Offers New Help in Placing Brass and Copper Orders

DAYTON—A new program to assist aircraft manufacturers in placing brass and copper orders has been established by Aircraft Scheduling Unit cooperating with brass and copper mills.

Under present regulations, brass and copper mills will not accept orders from aircraft manufacturers when the mill capacity is filled, even though the order is covered with a CMP allotment number. Normally, the manufacturer would then be forced to check all the remaining mills in an attempt to place his order, thus losing valuable time.

Mills Report Idle Capacity

To avoid this, the mills voluntarily offered to supply the Non-Ferrous Sub-Unit, which will handle the new program, and which is a part of the Materials Distribution Branch, Resources Control Section, Material Command, Steele High Building, here, with weekly reports listing their open capacities. Any manufacturer who is unable to place his order should immediately contact the Unit, giving complete information, by letter, telephone or wire. The Unit will check the list of open capacities and place the order verbally with the mill in behalf of the manufacturer; he will then confirm it.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

FARM MACHINERY—Fabrication of items of farm machinery for which critical material has been allotted within the period April 1 to June 30, 1944, does not have to be completed until Sept. 30, 1944. Order also includes other minor changes for clarification purposes. (Limitation Order L-257, Amended.)

HAND TOOLS — Manufacturer may put in process steel for manufacturing, stamping, forging or otherwise fabricating hand eye hoes not subject to limitations set forth in Table 5 of Appendix A to schedule, provided they are for export. (Limitation Order L-157, Schedule V, Amended.)

MOTORS—If it is practice of seller of such equipment to take in trade broken down motor and repair it for redelivery to another customer, the sale for replacement is within the exemption provided by paragraph c. (Limitation Order L-123, Interpretation 3.)

STEEL CASTINGS—Quantity differentials applicable to maximum prices have been revised to meet changed conditions in production and deliveries. (Revised Price Schedule 41, Amendment 7.)

Wartime Washington

Procurement agencies and WPB, blaming lessened production on over-confidence, cry "wolf," while planning return to civilian goods output, and while Congress plans the conversion period. But business is expected to work, not to plan its future

Industry Must Not Dream War Production Board is in the enigmatic position of painting gloomy war pictures, to overcome rising public confidence (which it says is slowing output), and at the same time programing a return to manufacture of certain civilian goods while considering the peacetime conversion of war plants.

To Up Civilian Production Paralleling the drive to keep war production at high pitch is a movement to allow production of certain civilian goods. WPB wants to keep the production set-up rolling at full tilt, but with the filling of the pipe lines and the accumulation of stocks and munitions, the needs of the home front are receiving consideration; as war needs in some categories decrease, the plan is to turn manufacturing facilities gradually but effectively to the production of essential civilian goods.

Has Definite Value The gradual conversion of civilian production will serve three purposes: It will prevent a break-down of home front activities; it will keep occupied and more readily available existing production facilities; and it will ease the shock and scramble of postwar re-conversion. Already WPB has authorized a resumption or an increase in the production of ten household articles.

Just how the return to civilian production will be apportioned has not been announced. Possibly it will be partially by use of non-trademarked merchandise: standard victory models made by several manufacturers.

"You Stop: I'll Go!" While WPB is making every effort to hold the brakes on swelling civilian confidence, it is understood also to be quietly looking into the matter of conversion of war plants. A memorandum which Ernest Kanzler completed before returning to civil life is said to deal with this subject.

Senate Dreams For Industry At the same time, the Senate is leveling its sights on the conversion period, with Senator Joseph C. O'Mahoney, Wyoming, heading a new Sub-committee on Postwar Industrial Organization which he says will try to evolve a peace time economic program based on a "traditional free economy and free government." He emphasizes that the new group, appointed by Chairman Walter F. George of the Special Postwar Economic Policy and Planning Committee, would not attempt to "impose a plan" on the American people.

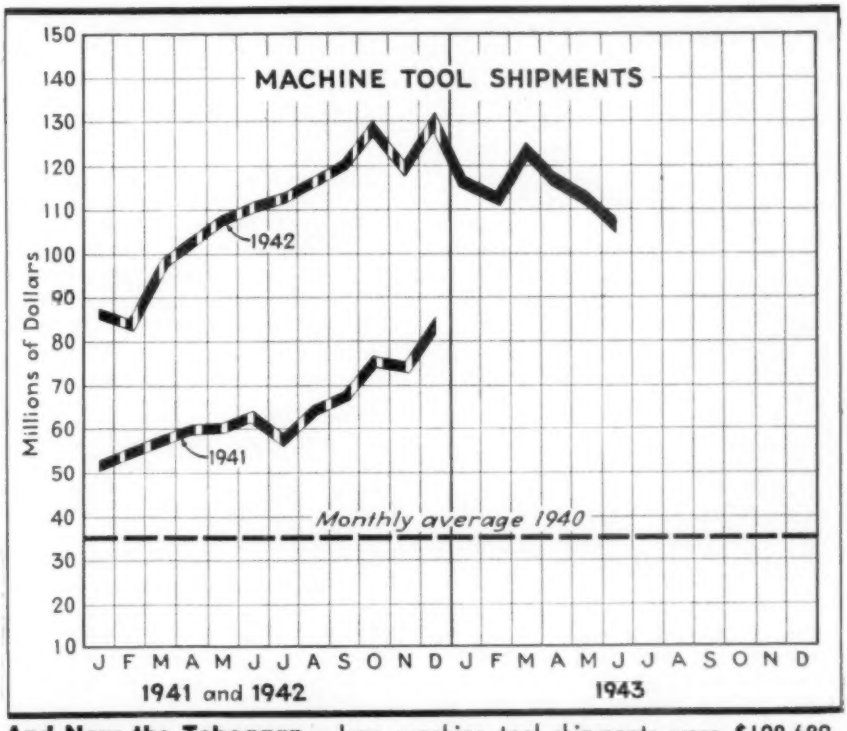
"By coordination of government, labor, agriculture, management and the consuming public on the home front," he said, "Americans can evolve an economic program thoroughly consonant with our traditional principles of a free economy and a free government. It is the subcommittee's purpose to get the various groups working together instead of at cross purposes."

NEW DISTRICT ORDNANCE CHIEF

NEW YORK — Col. Gilbert I. Ross has been appointed chief of the New York Ordnance District. A graduate of the Sheffield Scientific School of Yale University, Col. Ross was a mechanical and consulting engineer until his reserve commission was made active in 1940. He was recently guest of honor at a luncheon given by manufacturers of the New York District and his colleagues.

Industry Rates A Seat So there you have the picture: government is trying with one hand to keep industry from postwar day dreaming, while with the other it sketches outlines of the days to come. Planning is good, but it would seem to any interested observer that business deserves to participate.

Building Lake-Ocean Ships A new type cargo ship is being built in Great Lakes yards. Larger than the typical lake steamer, but small enough to allow passage through the locks, it is reported capable of trans-oceanic voyages. Whether this indicates an attempt to haul cargoes directly from lake ports to foreign points, no one will say.



And Now the Toboggan—June machine tool shipments were $108,689,000, 5 percent off May's $113,710,000, while net orders for June dropped to $38,322,000, 21 percent off May's $48,091,000. The cumulative backlog for June stands at $511,478,000. The substantial drop in new orders is a result of the current cutbacks in the ordnance program and in the machine tool program itself. Shipments declined less than orders, due to the backlog

To Clarify Their Aim—That employees might understand the importance of the work they are doing, Republic Steel Corp. staged a "Production for Victory" war exhibit in three circus tents, complete with holiday atmosphere. Over a hundred manufacturers loaned war products. Republic executives, l. to r., C. M. White, vice president in charge of operations; R. J. Wysor, president, and T. M. Girdler, chairman of the board, examine a Stinson airframe at the exhibit

Machinery and Equipment to be The Bulk of Canadian Lend-Lease

OTTAWA—Canada's machinery and machine tool plants will share the first large orders placed by the Canadian government under its billion dollar program of mutual aid for the United Nations—the dominion's counterpart of lend-lease.

Total volume of war equipment and machinery and tool orders to be placed under the mutual aid program during the next ten months is expected to approximate $600- to $700,000,000. Balance of the billion dollars of mutual aid will be wheat and flour for Russia.

Canadian production and purchasing officials now figure that requirements of relief and rehabilitation for the occupied countries of Eurpe as they are liberated by allied armies will merge with the mutual aid program to ensure close to capacity production for Canadian machinery and tool industries for the balance of the war period and for the first years after the defeat of the Axis. After that, they count on multilateral trade pacts and a new international exchange system to keep these industries busy indefinitely after the war.

Insiders have regard as a certainty the replacement at the end of the war of the Empire trade pacts by broad multilateral trade agreements which will procure larger markets for Canadian industry—although perhaps lowering tariff barriers against the importation of machinery products from the United States.

To Increase Imports

Revision now in prospect of Canada's war exchange conservation act passed at the end of 1940 for the purpose of conserving the dominion's supply of U. S. dollars for the purchase of war supplies may increase Canadian buying of some lines of electrical equipment, office equipment and other machinery supplies for which this country depends mainly on U. S. plants. With the exchange situation becoming increasingly easier, need for import restrictions is less urgent.

Output of farm machinery is allowed to increase by as much as 130 percent over the next 12 months from the previous corresponding period under a relaxation of restrictions ordered by Wartime Prices and Trade Board's farm machinery administrator.

The order specifies that farm equipment may be produced to 77 percent of the 1940-41 average. Up until now the limit was 35 percent.

Under the order repair parts may be turned out up to 156 percent of the 1940-41 production, which compares with the previous allowance of 150 percent. The average of new machines and repair parts and attachments works out to about 90 percent of 1940-41 tonnage.

More Farm Machinery

Distribution of farm machinery has been under a ration order since October and this will continue. But some lines of equipment the production of which was discontinued entirely will now be made again.

Rubber-tired tractors and combines are permitted to be made for distribution in certain areas under the new order, which places Canadian restrictions more closely in line with those of the United States. Previously manufacturing curtailment regulations were more severe in the dominion than below the border.

Anti-Strike Law Invoked

For the first time in two years Canadian authorities have invoked the law which makes it a criminal offense for persons to agitate for strike action in war plants. A Canadian Congress of Labor official was jailed in Montreal for advocating a continuance of a strike in the big Vickers shipyards which tied up the plant during the third week in July. Previously the federal government had seized control of shipbuilding plants at Quebec which were tied up by strike action.

Plant Shows Rod Making

CLEVELAND—A demonstration of a new and complete welding rod processing plant has just been concluded by the local factory of the Moslo Machinery Co., designers and builders of special machinery. During its operation, the plant was viewed by representatives of rod making companies, welding engineers and representatives of foreign purchasing commissions.

Visitors saw rod processing from start to finish. Beginning with the weighing and mixing of flux, straightening and cutting the wire, through to final inspection and packing, every step in rod production was carefully examined by onlookers and Moslo experts were there to explain technical points of the operation.

Complete runs, from the mixing of flux formula to final inspection, were made each day. Before the end of the ten-day run of the show, attendance reached a point where it was necessary to make runs both morning and afternoon.

The plant is now being dismantled for shipment abroad.

Spotting The Air News

NACA laboratories work on devices to increase safety, manoeuverability of planes. New combat planes now being tested will shorten the war. Flivver plane development interests manufacturers. The P-51 is rated best of class

Dr. George W. Lewis, director of aeronautical research for the National Advisory Committee for Aeronautics (government laboratory for both civil and military aviation), has gone to the West Coast for a series of conferences with aircraft manufacturers to accellerate development of new combat models. Ordinarily in peacetime NACA is a long-range pure science organization dealing more with problems of the future than the present. But since the war drive began, Dr. Lewis and his three great laboratories have been working on problems of immediate importance. De-icing devices for wings, propellers and carburetors was and is one of the important jobs. In modern air war, no less than in civil air transport, ice often took greater toll of equipment and men than the enemy.

Other current problems are constant speed and automatic feathering propeller hubs, superchargers to hold up engine power on an evener curve to higher elevation, better wing design for more lift, elevation and performance without loss of too much speed, etc.

Several new combat planes are in the air. Whether they get into this war depends upon how long the war lasts—and upon the ingenuity of aircraft experimental engineers. There are several heavy bombers, two in the air and one about ready. One of them can fly half-way around the world with an effective bomb load and the air force wants it particularly to go after Japan. There are several other combat types, including fighters, all involving some new aerodynamic wrinkles. The enemy can be decisively beaten with the equipment we have in production, but if we can get some of the new ones to work they will shorten the ordeal.

Every metal working firm is interested in the development of small personal planes, which might possibly sell in droves comparable to sales of automobiles. The helicopter is only one bidder for first place in the hearts of Sunday flyers. Before the war, there were several super-safe small personal planes, like Hammond, Weick and Erco, which it was said were flown by ordinary people without instruction.

Now comes William B. "Bill" Stout, recently-appointed head of Consolidated Vultee's Stout Research Division, for 20 years one of the world's most forward-looking air designers, and proposes three more personal aircraft. One of them is a three-passenger automobile with four wheels and folding wings, weighing about 1,500 lbs., having a standard 60-in. tread on regular tires, doing 60 to 70 m.p.h., and considerably more in the air. This is about half the weight of the average road flivver. Mr. Stout is depending on engineering in place of weight for easy riding. He calls this one the Aerocar; it is first an auto, second an airplane.

His second proposal is a roadable plane, which is primarily an airplane, second a road flivver. It weighs only 800 lbs., has a wing spread of 30 ft. and a range of 400 miles per filling of fuel. It will do over 100 m.p.h. in the air, but only about 35 on the ground.

Third is Helicab, built of light steel and dural sheathed with a new plastic. It is powered with a conventional 125 h.p. engine, carries two passengers with baggage and will gross about 1,700 lbs. This craft is of course much like the Sikorsky design, with horizontal lift rotor and rudder rotor, both having controllable pitch blades. Stout is trying to simplify the pitch controlling mechanism. The basic principles of the helicopter are in the public domain; inventors will be refining them for years to come.

All this adds up to the conclusion that a scrap is on between fixed wing planes and direct lifters. The plane people are trying to meet the convenience of the rotor machines by making them roadable. One thing to remember is that any kind of a fixed-wing airplane has to have speed for both landing and takeoff. And if it loses speed at low altitudes it falls plunk on the ground. Despite all the fancy wing flaps and wing designs, this will remain true to a large extent for some time. It scares the wits out of timid people.

By common consent, the North American fighter, P-51 Mustang, is the best of its class in the world right now and for some time past. The company has just revealed that some P-51's are being equipped with 20 mm. cannon (roughly three-quarters in.) which makes them poison to trains, locomotives and small ships, including any submarines caught with their decks awash. There has been no official information about the 37 mm. cannon lately, but officers talking off the record said it was too slow and that the plane could carry too few rounds of ammunition. Fire from airplanes is essentially a spraying process, not aim-and-fire and the gunners like to have plenty of shots. Well-informed persons can argue themselves hoarse over the recent report by the Truman committee on Army, Navy and Curtiss-Wright and get nowhere. But when one said that the Air Force could have put the P-51 into production instead of the P-40, there is no good answer; the P-51 was there all the time.

Real Life Drama — Films showing good and bad welding practices are cutting average beginning welders' training periods by as much as 20 percent. Prepared by General Electric at its Schenectady plant, welding instruction films have been used throughout this country and sent to England, Canada, Brazil and South Africa

International

Lippincott

Chambersburg Engineering Co. President E. C. Clarke, above, left, received the award from Col. T. C. Lanphier, center, who called attention to the fact that just 80 years ago troops were marching through Chambersburg. Merle Beam, right, represented employees

Philadelphia Gear Works employees heard stressed the importance of gears to the entire war effort. Above, l. to r., are employees H. G. Wilkinson, Thelma Allibone, James Blake, George Seibold and Mrs. Jean Detterline and President R. C. Ball

More Firms Win "E" Awards For Excellent Production

WASHINGTON—Outstanding performance on war work has won the Army-Navy "E" Award for the following:

Advance Stamping Co. (Detroit) plant), Aeronca Aircraft Corp., American Type Founders C. H. Cowdrey Machine Wks. Div., Automotive Maintenance Machinery Co., Bastian-Blessing Co. (Chicago plant), Bendix Aviation Corp. Julien P. Friez & Sons Div., Blaw-Knox Co., Borg-Warner Corp. Norge Div., Bristol Co., Brown Instrument Co., Carborundum Co., Christensen Machine Co., Cincinnati Gear Co., Detroit Gasket & Mfg. Co. (Burt Rd. plant), Detroit Harvester Co. Dura Div., Dow Chemical Co. Gt. Western Div., Eugene Dietzgen Co., E. I. du Pont de Nemours & Co. Oklahoma Ordnance Wks., General Electric Co. Plastics Dept. (Plant 1), General Machine Co. (Newark plant), General Machinery Co., William D. Gibson Co. Div. of Associated Spring Corp.

H.R.L. Machine Wks., Hannifin Mfg. Co. Ordnance Div. (Plant 2), Jacobs Mfg. Co., R. G. LeTourneau, Inc., Metro Tool & Gage Co., Pacific Gear & Tool Wks., Phoenix Tool & Mfg. Co., Revere Copper & Brass, Inc. Baltimore Div., Spicer Mfg. Co. (Pottstown plant), Taylor Instrument Companies, United States Bronze Powder Wks., Westinghouse Electric & Mfg. Co. Meter Div. and S. Louisville plants, Wiremold Co., L. A. Young Spring & Wire Corp. (Trenton plant), Zollner Machine Wks.

Shifting War Needs Close Some Army Ordnance Plants

WASHINGTON—Changing war and lend-lease needs have resulted in the suspension, closing or cancellation of completion of eight Army ordnance plants, the War Department has informed the House Military Affairs Committee in a letter to Chairman Andrew J. May, of Kentucky.

Wrote Undersecretary of War Patterson, "the closing of these plants has, no doubt, brought inconvenience and dislocation to the local communities, and has directed public attention to idleness which may be inappropriately termed 'waste.'

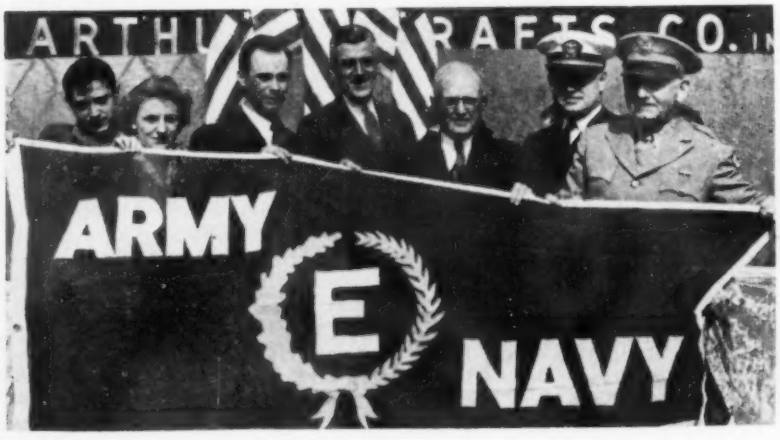
Enough, Soon Enough

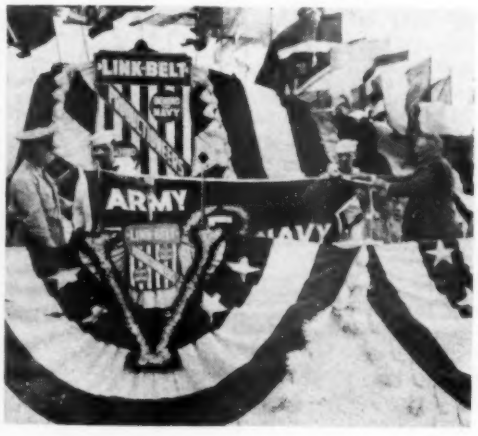
"Had these facilities not been courageously conceived, planned, and constructed, and had the fortunes of war continued to be adverse, the great destruction and waste of both manpower and money caused by having too little too late would have brought such tremendous suffering that the present

Arthur A. Crafts Co. employees, l. to r., below, J. J. Annese, Dorothy Clarke, M. J. Hoylo, Jr. pose with Massachusetts Governor Leverett Saltonstall, President F. L. Huston, Lt. Com. J. F. Morgan and Lt. Col. J. C. Solberg after the burgee had been awarded to the company and pins to employees

Link-Belt Co., Ewart plant, received the "E" award from Col. F. W. McMahon, chief, Cincinnati Ordnance District; Frank S. O'Neil, company vice president and general manager of plant operations accepted it, below. Approximately 6,000 employees, relatives and friends attended the ceremony

Fay Foto

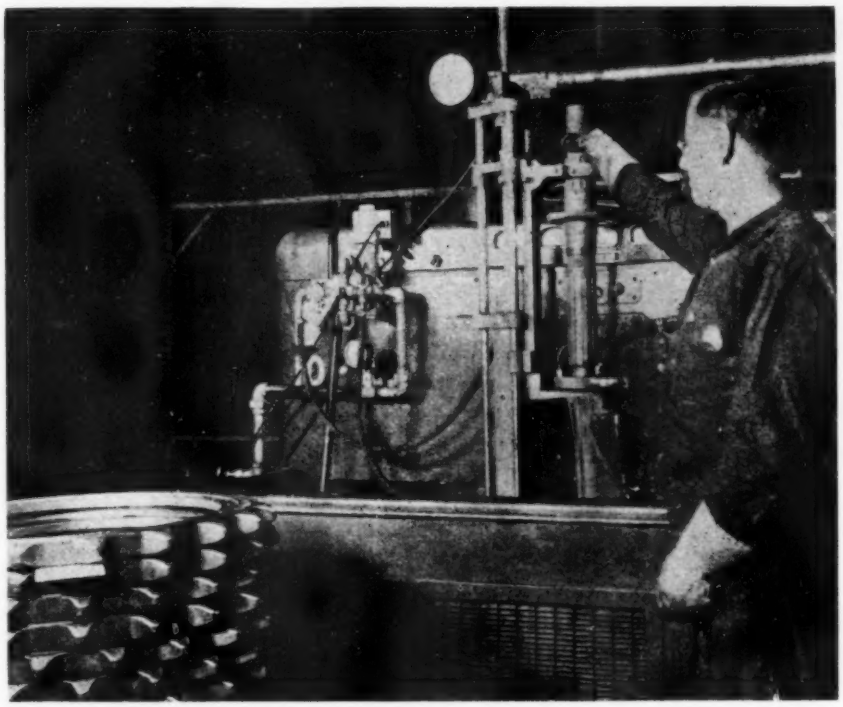




inactivities fade into insignificance."

The eight plants are the New River Ordnance Plant, Pulaski, Va.; Mississippi Ordnance Plant, Flora, Miss.; Cactus Ordnance Works, Sunray, Tex.; Lake Ontario Ordnance Works, Youngstown, N. Y.; Gopher Ordnance Works, St. Paul, Minn.; Pilgrim Ordnance Works, West Hanover, Mass.; Vigo Ordnance Works, Terre Haute, Ind., Scioto Plant, Marion, Ohio.

Undersecretary Patterson's letter explained that the War Department had planned facilities with the expectation that overseas munitions plants might be destroyed, but that "As the trend of the war changed and our air strength increased, interruption in the munitions industries of our allies dropped sufficiently so that instead of the anticipated tremendous increased demands, we had reductions in lend-lease requirements. The effect of such changes upon our production schedules was disturbing, but the underlying causes were so favorable that they overshadowed our own disruptions."



Tank Part Toughener—An operator positions a 26-in. bevel gear shaft in the inductor of a Tocco process induction hardening machine. The gear shaft is a component of tank transmissions used by the English Eighth Army in Africa. According to reports, hardening triples the parts' useful lives

NAMES in the NEWS

Ralph J. Cordiner, former vice chairman of the War Production Board, has been named assistant to the president of General Electric Co., Schenectady, N. Y. Previously Mr. Cordiner had been president of Schick, Inc., makers of the Schick dry shaver.

Frank Cordes has resigned as chairman of the board of Blaw-Knox Co., Pittsburgh, makers of steel products, and has become president of Pittsburgh Steel Foundry Corp., Glassport, Pa., succeeding Parker Wilson.

Frank H. Buckingham has been appointed president of Sandusky Foundry & Machine Co., Sandusky, Ohio, makers of cast bronze, brass, copper, liners, bushing, sleeve rings, succeeding Devereux Lake who has resigned.

Fred T. Whiting and Charles A. Dostal, district managers of Westinghouse Electric & Mfg. Co., have been appointed vice presidents. Mr. Whiting heads the company's northwestern district with headquarters in Chicago, while Mr. Dostal is manager of the Pacific Coast district located in San Francisco. The duties and headquarters of both men remain unchanged.

Grant B. Shipley has been named president of the Elliott Co., Jeanette, Pa., producers of steam power equipment, to succeed H. M. Hubbard who has resigned. E. C. Brandt has become a director and vice president in charge of manufacturing, while W. A. Elliott, vice president, becomes vice president in charge of sales. Announcement has also been made of the promotion of F. W. Dohring to general sales manager.

J. L. Mauthe

J. L. Mauthe has been named vice president in charge of operations of Youngstown Sheet & Tube Co., Youngstown, Ohio, succeeding the late William B. Gillies. Mr. Mauthe joined the company in 1935 as assistant superintendent of the Campbell plant and two years later became geenral superintendent. He will head the company's Youngstown and Chicago district manufacturing operation.

Alfred Marchev, executive vice president in charge of operations at Republic Aviation Corp., Farmingdale, N. Y., has been advanced to president to succeed Ralph B. Damon, who joined the corporation on a loan basis from American Airlines two years ago. Mr. Marchev became associated with Republic early in 1942 as assistant to the president, later becoming vice president and general manager of the corporation.

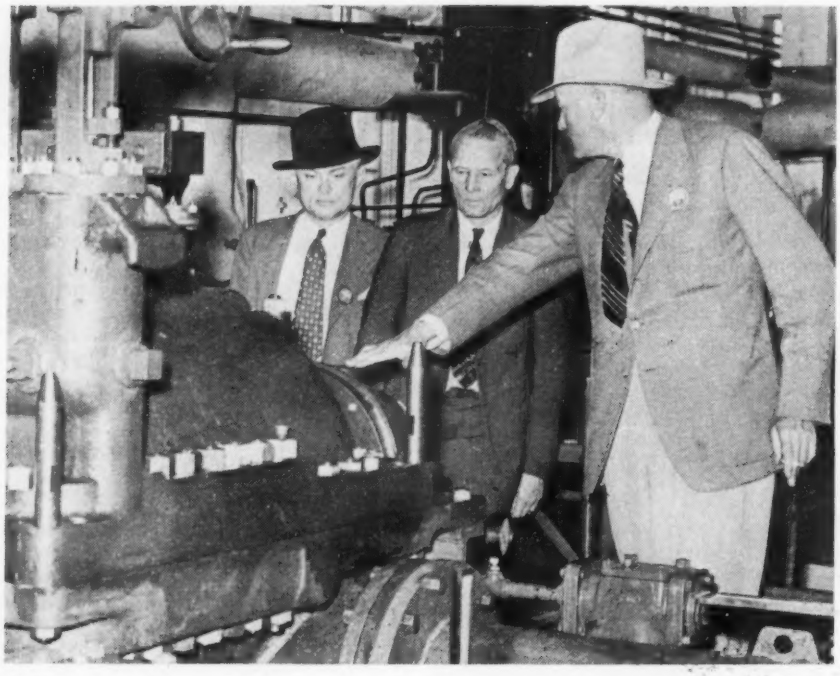
C. K. Pistell, executive vice president of Harvill Corp., Los Angeles, die casting and hydraulic manufacturers, has been elected president of the organization. He is also a member of the board of directors of Breeze Corp., Newark, N. J., makers of flexible metal hose and tubing, aircraft products, stainless steel products, and of Lukens Steel Co. Paul R. Jordan, formerly technical service director, has become general manager.

Receive Promotions at Harvill

C. K. Pistell

P. R. Jordan

H. B. Harrison has been appointed general sales manager of Ferracute Machine Co., Bridgeton, N. J., builders of power presses. Prior to Mr. Harrison's association with Ferracute, he was sales engineer with Bucyrus-Erie Co., Milwaukee, makers of power shovels, dredges, cranes.



Power for Cargo Ships—Carl Flesher, regional director, Maritime Commission, Admiral Emory S. Land, Commission chief, and Charles E. Moore, president of the Joshua Hendy Iron Works, inspect one of that company's marine turbines for C-1 cargo vessels. Hendy is the only Pacific Coast producer of marine turbines, now produces two sizes for main power

Harvey McKenney has been named manager of alloy steel sales, a newly created post in Follansbee Steel Corp., Pittsburgh, producers of sheet metal and sheet metal products. Mr. McKenney has been associated with Carnegie-Illinois Steel Corp. and Crucible Steel Co. in production work.

Thomas Sayles has become general superintendent of Rotary File Co., makers of rotary files and burrs; while Charles Ivers, formerly superintendent, has been made sales manager of the company.

Henry K. Beebe has joined Wales-Strippit Corp., manufacturers of punching and notching equipment, of N. Tonawanda, N. Y., as works manager. He was formerly connected with Brewster Aeronautical Corp., Long Island City, as chief plant engineer, Bell Aircraft Corp., Buffalo, and has served in various capacities with Ford Motor Co. before becoming superintendent of its Buffalo plant.

Eugene P. Harter, sales manager of Electro Refractories & Alloys Corp., Buffalo, makers of grinding wheels, electric furnace products and special alloys, has been advanced to general sales manager. Mr. Harter has been head of the company's Grinding Wheel Div. since 1941 and previous to that he was engaged in sales and administrative work in tool steels with Universal-Cyclops Steel Corp., Titusville.

G. B. Sheers has been made president and general manager of Standard Horse Nail Corp., New Brighton, Pa., manufacturers of machine keys, nails; and R. S. Merrick has been named vice president.

Brig. Gen. Alfred R. Clancy of the Army Ordnance Dept. received the citation of the Legion of Merit for his service as chief of the Tank-Automotive Center in Detroit. He was commended for his accomplishment in efficient coordination in the production of Army equipment. Gen. Clancy was president of General Motors Corp. before entering the Army when he retired several years ago from private business.

OBITUARIES

Charles H. Wilkinson, 61, president of Logansport Machine Co., Logansport, Ind., manufacturers of air and hydraulic equipment, recently passed away in Cleveland.

Francis J. Blum, 76, vice president and treasurer of Armstrong-Blum Mfg. Co., Chicago, producers of hack saws and blades, band saws, shearing and tapping machinery, vises, died at his home in Oak Park.

C. J. Qualter, general manager of the gear department of Meisel Press Mfg. Co., Boston, passed away recently.

Charles L. Bransford, vice president of Lone Star Steel Co., Daingerfield, Tex., died at his home in Brmingham, Ala., at the age of 56. From 1938 until 1941 Mr. Bransford had been Birmingham district manager for Republic Steel Corp.

G. A. Gallinger

George A. Gallinger, vice president of Ingersoll-Rand Co., New York City, makers of pneumatic tools, pumps, blowers, refrigerator units, other plant equipment, died at his summer home in Cape Vincent, N. Y., at the age of 64. Mr. Gallinger began his career with the New York Air Brake Co., Watertown, N. Y., as a machinist, and joined the pneumatic tool division of Ingersoll-Rand 35 years ago. At the time of his death he was in charge of the railway equipment department.

George S. MacMaster, 47, who had been district manager of Otis Elevator Co. in Los Angeles, died in that city.

George D. McGill, 52, died in Chicago recently. He had been president of McGill Metal Products Co., Marengo, Ill., makers of money changers.

William Dyson, owner of Hallidie Machinery Co., Seattle, passed away there a short time ago.

Louis Hyman passed away after an illness of about two years. Mr. Hyman was associated with his father and brothers in the firm of Joseph Hyman & Sons, Philadelphia, which specializes in the rebuilding of metal stamping presses.

Carl F. Millican, 48, president of Challenge Tool & Gauge Co., Indianapolis, died as the result of a plane accident near Monticello, Ind. He had been associated with the company since 1916.

MEETINGS

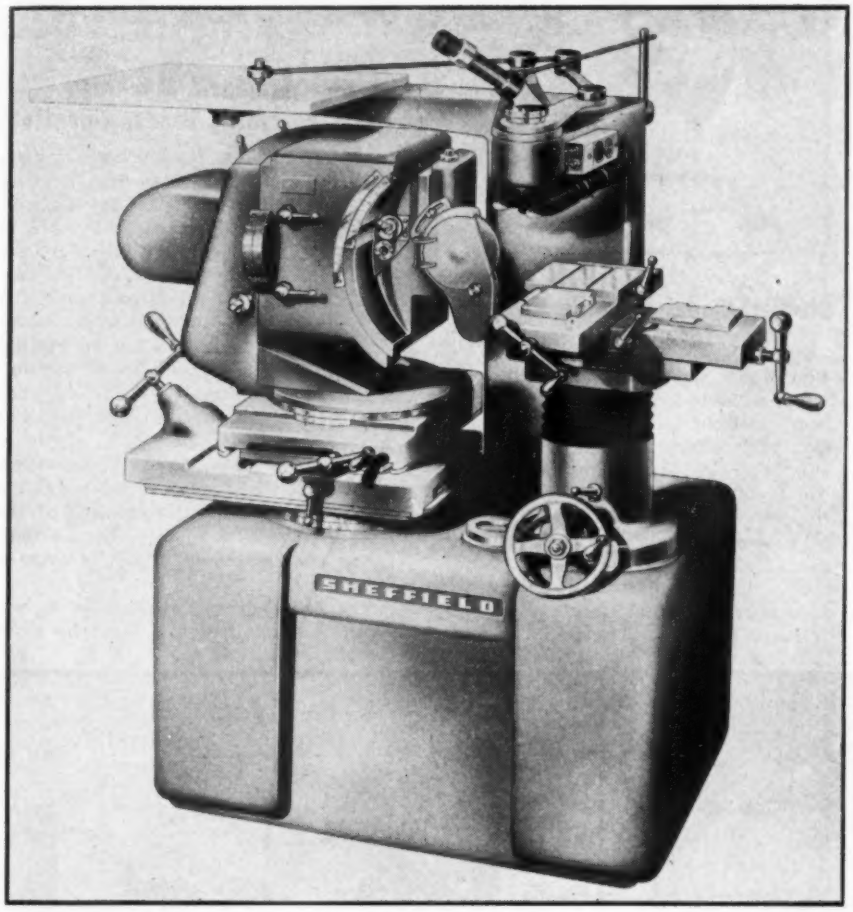
Society of Automotive Engineers, Aircraft Engineering & Production meeting. Biltmore Hotel, Los Angeles, Calif. Sept. 30-Oct. 2.

National Metal Congress & Exposition. Annual meeting. Palmer House, Chicago, Ill. Oct. 18-22.

American Welding Society. Annual meeting. Hotel Morrison, Chicago, Ill. Oct. 18-21.

Shop Equipment News

Sheffield Micro-Form Grinder With Microscope Finish Grinds Parts Directly From the Drawing



Circular and flat form tools, templets, profile gages, cams, dies and other parts from hardened materials including tungsten carbide can be finish ground directly from the drawing on the Micro-Form grinder brought out by Sheffield Corp., Dayton, Ohio. An accuracy of 0.0003 in. can be obtained in the grinding operation by the use of the pantograph which has a 50 to 1 ratio between the movement of the stylus and the microscope.

This machine has a direct working range over an area of 0.400X0.400 in. in one setting, corresponding to the 50 to 1 reduction of the drawing which is 20 in. square. Work may be accommodated up to 10 in. wide and 4 in. thick. The stock can be stacked as high as 2 in. to produce several identical parts at one operation. Profiles greater than 0.400 in. in area can be handled by other methods with the same equipment. The machine can also be used reversely for making 50 to 1 layout drawings from parts with unknown profiles and for checking parts against layout drawings. The grinder occupies a floor space 40X58 in. and weighs 2,400 lb.

The layout drawing made to a scale of 50 to 1 is placed on the drawing table of the pantograph where the microscope is mounted on a short arm. When following the lines on the layout drawing from point to point with the stylus, the microscope equipped with crosshairs moves exactly according to the profile to be ground. The operator feeds the grinding wheel so that its cutting edge works toward the point marked by the crosshairs which corresponds to the position of the stylus.

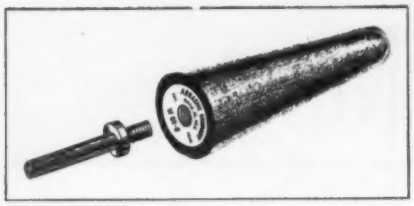
When profiles larger than 0.400 in. are to be ground, the drawing may be laid out by either of two methods on a 20X20 in. sheet. One method is to lay the lines that correspond to the profile in each consecutive area of the square one upon another. The longitudinal and cross-slides of the work head are moved 0.400 in. before starting each 0.400 in. segment of the profile. This movement is facilitated by placing the proper precision blocks against the slide stops and by use of the dial indicators mounted on the work head. The second method is to subdivide the profile according to distinct points and place the lines representing the subdivision one upon another on the drawing. The work table is moved according to the distance between the end of one segment of the profile line and the beginning of the next, using precision blocks and the dial indicators.

The grinding wheel can be set at any desired angle to move in any direction by means of the arrangement of cross and circular slides, and other adjustments which give the effect of a double universal joint. This permits the forming of any shape and makes possible the grinding of rake and clearance angles simultaneously with grinding of the form. The base part of the grinding head, with cross and longitudinal slides and swivel mountings, enables the grinding wheel to be set and moved in the horizontal position. The upper part, by means of horizontal and vertical slides, gives the angular position to the wheel. The driving mechanism, and gear which actuates the variable reciprocating motion of the wheel slide, are included in the upper part. The grinding wheel has a maximum vertical reciprocating stroke of 2¼ in.

The work head is mounted on a column and is adjustable vertically. The compound table permits the work to be positioned both crosswise and lengthwise, and locked in place for the grinding operation. To limit the movement of the slides, stops are provided in the center of the ways of the longitudinal and cross-slides. After being set the slides are clasped one upon another by a locking arrangement which prevents accidental movement.

Abrasive Victory Points Have Demountable Spindles

Victory points with demountable spindles have been made available by Abrasive Co., Tacony and Fraley Sts., Philadelphia 37, Pa. They consist of a threaded porcelain bushing inserted in



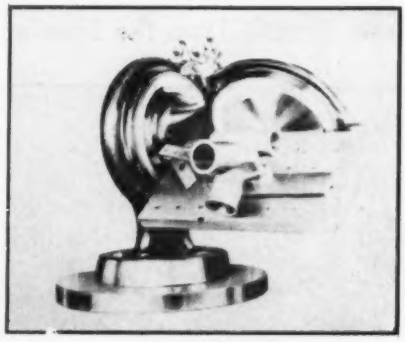
and fused to the abrasive wheel mass. The points are made in standard grain and grade combination in vitrified bond, while the demountable spindle size is limited to ¼ in. diameter and 1¼ in. long.

The demountable spindle screws tightly into the porcelain bushing and threads turn in the opposite direction of rotation of the grinder. When the abrasive point is used up, it is backed off the spindle and a new one installed.

Tabl-Spray Metal Washer Takes Flat or Circular Parts

For high-speed washing of flat work or circular parts with intricate pockets and crevices, American Foundry Equipment Co., 555 South Byrkit St., Mishawaka, Ind., has produced the Tabl-Spray metal washing machine. Parts to be cleaned in the machine are placed on the mesh table and rotated through the spray solution, discharged from non-clogging nozzles. Parts measuring 25 in. in diameter and 12 in. high can be handled on the Tabl-Spray.

The unit operates with either an alkali washing solution or with a solvent emulsion. After the required washing time, the solution valve is closed and the parts are left rotating to obtain proper drainage. If rinsing with fresh water is desirable, this operation can be handled without transferring parts to another compartment by means of a special arrangement of drainplates. To remove excess liquid from the parts, a compressed air blowoff can follow the cleaning. The spray system is removable for cleaning and fully accessible for adjustment.



Studler Model B Angle Computer Has Three-Direction Rotation

The Model B Studler angle computer, with a 9X16 in. surface plate, has been brought out by Angle Computer Co., 5720 Melrose Ave., Los Angeles, 38, Calif. It is designed to simplify the layout of die work, and is suited for survey of castings, and inspection of precision-machined parts, handling in excess of 75 lb.

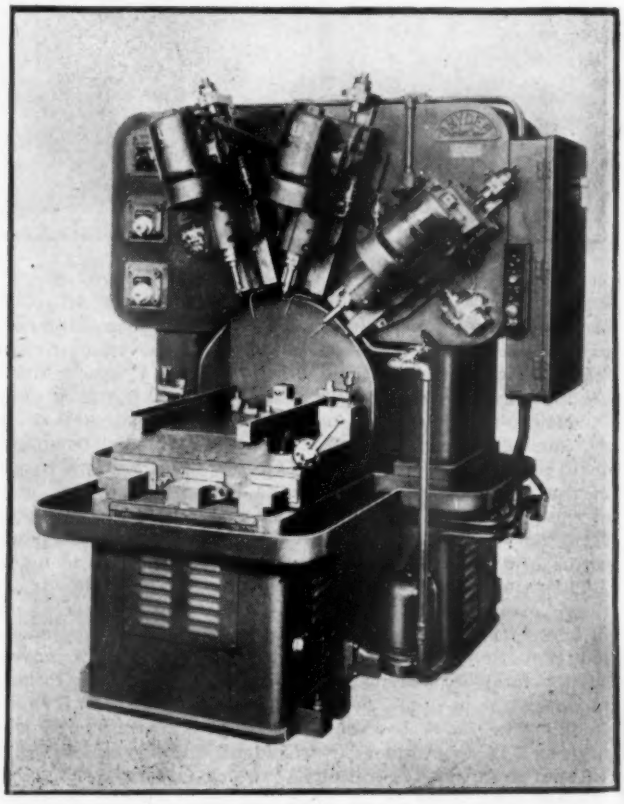
The surface plate is provided with horizontal, vertical and radial directions of rotation. The part or casting is clamped to the plate, and every angle or compound angle is calculated or checked by means of dials equipped with verniers. The dials are graduated from 0 to 90 deg. in four sections of the circle. The dial recording horizontal rotation is equipped with two verniers, while the other two dials have one vernier each. All verniers read in 5 min. spacings.

The frame of the computer is made of an iron alloy, heat-treated to minimize warpage or metal distortion. The surface plate is provided with tapped holes for clamping the plate. Bearing wear is taken up by a heavy spring pressure applied to the flanges.

Snyder Automatic Machine Mills Binder Bar Slots

A special automatic machine has been built by Snyder Tool & Engineering Co., 3400 East Lafayette St., Detroit, Mich., for milling binder bar slots in aircraft cylinder heads. The slots are angularly arranged in three fin sections, and are all cut at one time. The part to be cut is located on a master locating plate and clamped on the fixture table, after which the starter button is pressed and the tools advance into the work and feed to the depth of 3/16 in. When this full depth is reached, the table automatically moves lengthwise and feeds the work against the tools for the entire length of the cut. At the end of this cut the tools automatically retract and the cycle is complete.

The finished part is replaced by another part, and clamped in the same



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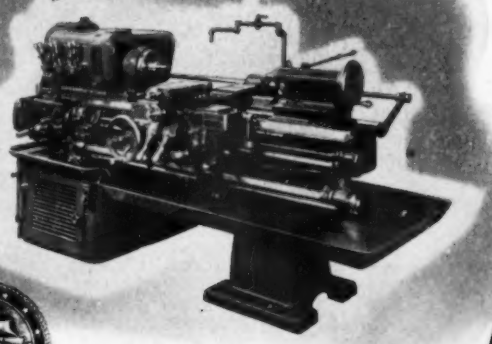


Since March 6, 1942

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES

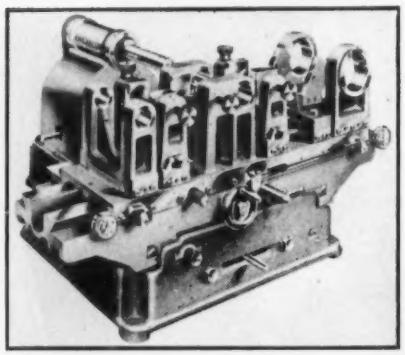
position from which the finished part was removed. The cycle is repeated with the table moving in the opposite direction for the lengthwise cut. This brings the table back into the position from which it originally started and eliminates the need for resetting the table between each cut.

The tools are double-end, straight shank end mills, having adjustment for wear on each unit through micrometer screws. The high precision, high-speed, ball bearing type spindles are each operated by an individual hydraulic cycle, and all three spindles are geared for simultaneous operation.

The three controls on the column are for the infeed of the tools and for the forward and backward feed movement of the fixture table. This table is hydraulically operated for the transverse feed stroke and rides on hardened and ground ways with a heavy center guide. The coolant pump is mounted on the base and coolant is contained in the front part of the base.

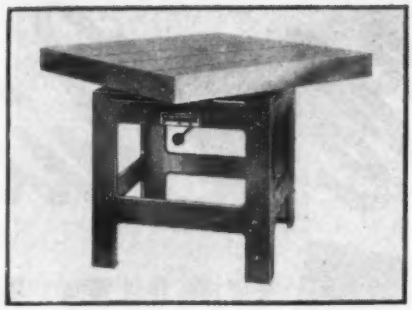
Century Offers Boring Machine For Handling Connecting Rods

A connecting rod boring machine has been introduced by Century Engineering Co., 816 West Fifth St., Los Angeles, Calif., for use in aircraft and industrial plants and all types of repair



stations. The machine is simple to operate and light enough for easy transportation. It requires only a single 110-volt connection and one air hose to be ready for operation. The base casting is rigid and suspended on three feet to prevent distortion.

The part to be bored is fed into the boring bar with a hydro-pneumatic feed. To bore a rod, spacer bars for the specific rod are used to set the rod centers. The rod is then placed in position on two mandrels and held until a self-centering and self-equalizing clamps are tightened. The mandrels are then removed and the first hole is bored. Without removing the part, the entire fixture is moved to the second position by means of a handwheel which operates the cross-slide, and checked with the dial indicator. As the rod is never released until both ends are bored, the holes are parallel without the possibility of any misalignment due to an extra setup.



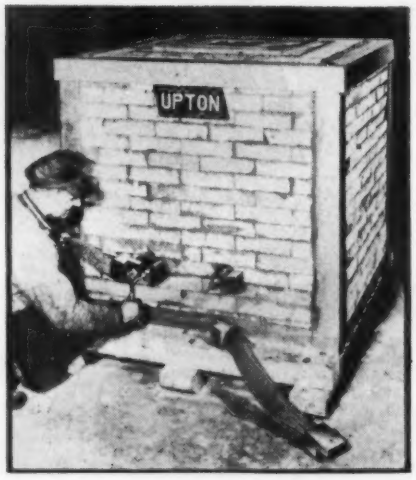
Challenge Turntable Suited for Progressive Mounting of Units

The turntable made by Challenge Machinery Co., Grand Haven, Mich., is suited for progressive mounting of two or more units at one time and for continuous production. It is furnished in two standard sizes, 30X30 in. surface, 3 in. thick and 42X42 in. surface, 4 in. thick. Each surface plate has four T-slots machined from the solid. Two models of the table are available. One is mounted on a cast iron stand and the other on a low base for use on machine beds. The stand model is 34 in. high while the drill base model is 9 in. high. A single-motion locking lever is provided for locking the table to the stand. On the low base model a special rim lock is provided.

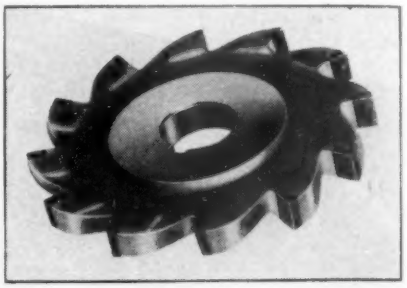
Upton Salt Bath Furnace Eliminates Electrode Change

The necessity for changing electrodes has been eliminated in the salt bath furnace brought out by Upton Electric Furnace Div., 7450 Melville, Detroit, Mich. The electrodes can be located beneath the surface of the salt or at the extreme bottom of the pot with none of the heated portion exposed to the air. Any portion that is exposed to the air in the sealed-electrode furnace is cooled by circulating water through the transformers so that the exposed portions are held at about body temperature. Thus, there is no oxidation of the exposed portion due to heat.

The company has built a furnace

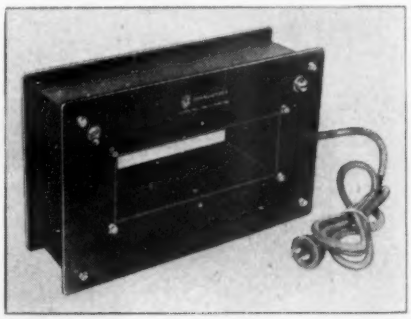


that is 37 in. deep with an area of 9 X 9 in., which is said to operate successfully with dimensions of such a depth. The furnace for heat-treating operations requires temperatures of from 1,200 to 2,500 F. Pots are of ceramic construction. The design will permit the building of furnaces of most any depth but without the usual proportionate increase in area.



Super Carbide-Tipped Cutters Are Made With Fewer Flutes

A carbide-tipped milling cutter with cast alloy body is being produced by Super Tool Co., 21650 Hoover Road, Detroit, Mich. Standard cutters for cutting cast iron, brass, bronze, copper, aluminum, magnesium and plastics are supplied in diameters from 3 to 8 in., in a variety of widths, with 4 or 6 flutes. For cutting steel, they are made with from 6 to 16 flutes, according to the diameter. It is said that the greater speeds at which these carbide-tipped tools can operate lead to increased table feeds and to faster speeds. On production jobs, these cutters are being used to mill steel at 400 to 600 surface ft. per min.



Alofs Portable Demagnetizer Is Produced in Two Sizes

Alofs Manufacturing Co., Grand Rapids, Mich., has developed a portable demagnetizer in two sizes, for 115 or for 220 volts a.c. This unit is said to eliminate the constant dulling of drills and tools caused by magnetization, and is useful in preparing parts for plating. Metal particles which often ruin the finish in the buffing process will readily wash off after demagnetizing before plating.

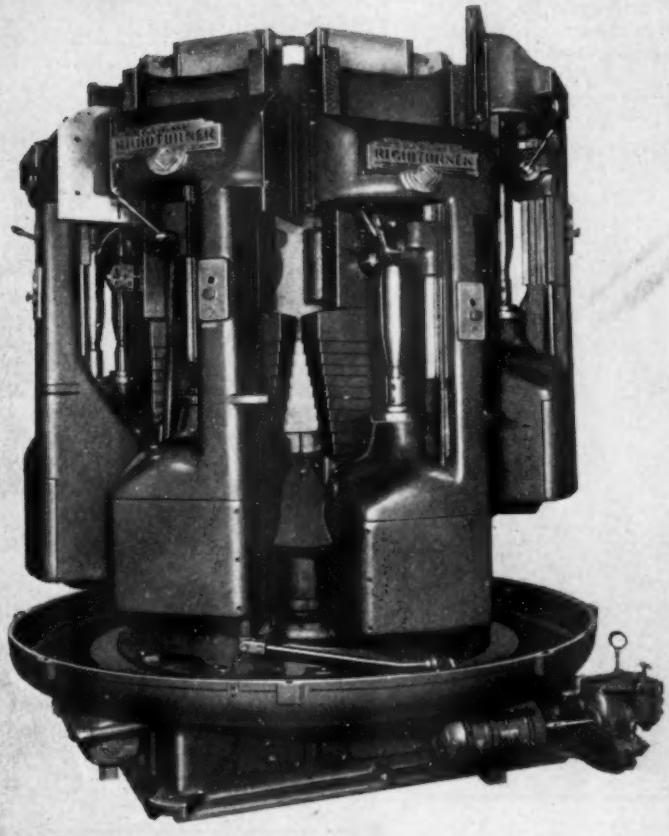
To demagnetize a tool, it is simply passed through the field of concentration, and then removed a distance of about 2 ft. before turning off the switch.

FOR MASS PRODUCTION OF [illegible]

THE RIGIDTURNER

The NEWEST *Thing in Multiple Diameter Turning*

ROTARY MODEL



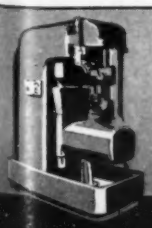
The Rotary Model Rigidturner is designed for the mass production of duplicate work on which there are various diameters to be turned.

The use of eight spindles all operating at one time, continuously, insures the maximum of production. Faithful duplication and continued accuracy is accomplished by the use of special form cutters.

Machine operation is automatic and extremely simple. Operator merely loads and unloads work at loading position—the machine does the rest.

The Rotary Rigidturner is making production records in many shops now engaged in turning shell up to 105 MM. The same method applied to post war operation will not only produce accurate work in quantity but turn it out at costs favorable to competing markets.

This Booklet tells what Rigidturning is—explains in detail the various functions of the machine—and shows its advantages for high production of accurate work at low costs. Write for your copy today.



The CLEVELAND HOBBING

Cleveland ... MACHINE Company ... Ohio

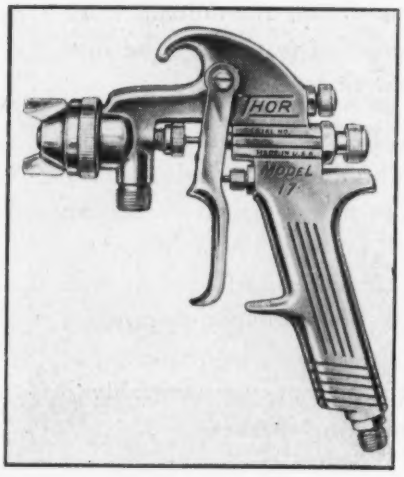
BUILDERS OF RIGIDHOBBERS AND RIGIDTURNERS

For magnetizing a tool, it is held in the field of concentration and the switch turned off, after which the tool is removed.

The smaller size unit measures 13X7⅞X4 in. over-all, with an opening of 2¾X8¼ in. This unit weighs 21 lb. Over-all size of the larger unit is 15X10X4 in., with opening the same size as the small demagnetizer, and weighs 25 lb. These demagnetizers are furnished with cord, switch and pilot lights, and have a smooth, flat back made of plastic which permits movement over flat surfaces without danger of scratching or marking the finish of the work.

Binks Model 17 Spray Gun Has Adjustable Spray Width

Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago, Ill., is producing the Model 17 Thor spray gun with a lusterless war finish. All controls are at the back of the gun. The width of the spray is adjustable from round to flat with all widths in between. This gun

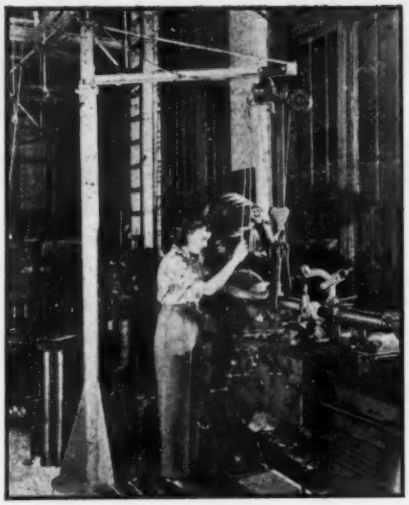


can be furnished with nozzle combinations for use with syphon feed cup, gravity bucket and pressure material container for applying any material to a surface.

An adjustable needle valve stem is provided to compensate for wear. Air hose connections are ¼ in., pipe thread and material hose connections are ⅜ in. The spray gun has a two-finger trigger and a comfortable hand grip. The simplicity of the nozzles with large passages is said to prevent clogging and to permit speedy cleaning. Shipping weight of this unit is 2¾ lb.

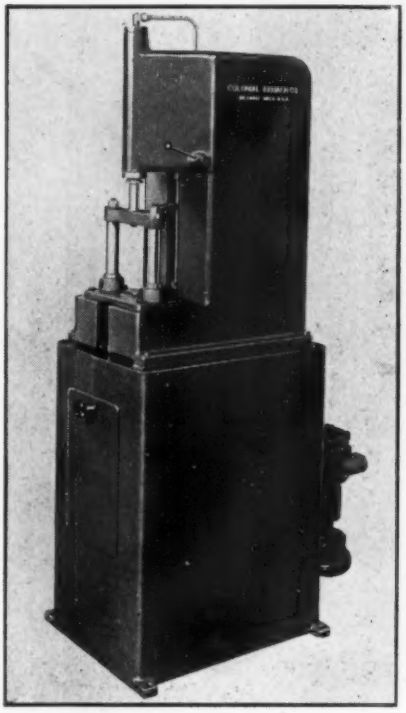
Cablemaster Cable Hoist Fits Monorail or Jib Crane

Master Electric Co., Industrial Equipment Div., Dayton, Ohio, has built a lightweight cable hoist known as the Cablemaster. It is equipped with a hook or trolley mount, and can be quickly attached to monorail mounting or to a 4-ft. jib crane. The hoist



is available in 250, 500 and 1,000 lb. capacities.

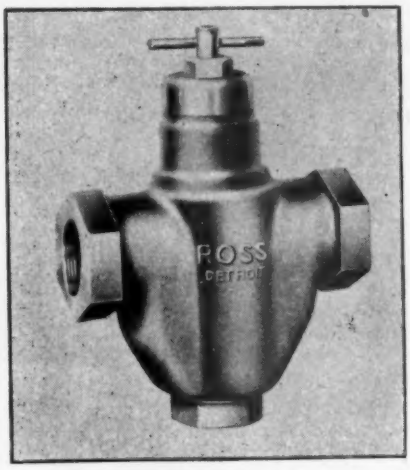
The Cablemaster may be installed at each machine tool or bench, eliminating waiting for the general overhead hoist. The unit has anti-friction bearings throughout, a trouble-free random wind drum, self-locking worm gear drive, reduction gears bathed in oil, and lower hook ball bearing mounted with ball bearing sheave. No special cable end fittings are required.



Junior Hydraulic Press Now Made in Base Type

The improved Junior hydraulic press line, produced by Colonial Broach Co., Detroit, 12, Michigan, is now being manufactured in a base type model in addition to the bench model. The puller mechanism and coolant tank are located in the base, and a coolant pump driven by an integral motor is provided on the rear of the base. In addition, the base type Junior may be used for push-type broaching operations requiring the use of coolant.

Pumps and reservoir for the hydraulic fluid are incorporated in the main body of the press. Ram speed is 30 ft. per min. downward, making it suitable for broaching as well as assembly work. A high speed return of 60 ft. per min. is provided for the upstroke. The stroke is adjustable up to a maximum of 12 in.

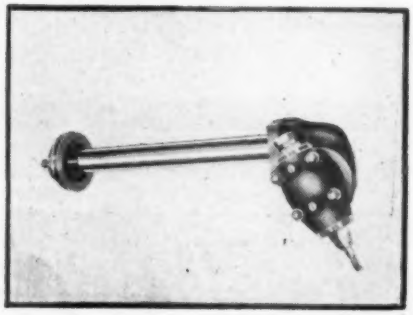


Ross Air Speed Control Valve Has Wide Range Flow Control

Accurate split-second timing of piston movements is provided in the air speed control valve brought out by Ross Operating Valve Co., 6489 Epworth Blvd., Detroit, Mich. A specially designed stem and floating bevel seat poppet maintain a positive steady control at any selected speed. It is said that starting with full capacity flow in both directions the flow in one direction can be controlled over a wide range to a completely closed position. Through a vernier-like adjustment mechanism, a greatly increased range of selective speeds is obtained.

Brown Milling Attachment For Milling Machine Overarm

A universal high-speed milling attachment, made by Leo G. Brown, 216 South Vermont Ave., Los Angeles, Calif., is suited for installation in the overarm bore of most makes of milling machines regardless of size. The



Information supplied by an Industrial Publication

One of the best ways of expediting machining is the use of tools that make several cuts simultaneously. True, such tools must usually be specially designed, but the time saved more than compensates for the effort of developing them.

A tool developed to do three operations simultaneously on an aluminum die casting is a good example. It is a combination drill, miller and facing cutter.

The drill which cuts flash from the center hole is in the middle. It is surrounded by a four-tooth hollow mill which removes push-out pins at the bottom of the annular recess between the inner and outer walls. Above the mill, on a flange, are four cutters that remove flash and face the top edge of the casting.

All of these operations are performed with the tool in a drill press spindle, the work being held by a simple fixture. The time saving between this method, requiring a single set-up and a single stroke of the drill press spindle, and the use of three set-ups and three tools is obvious.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Mo-lyb-den-um Company
500 Fifth Avenue • New York City

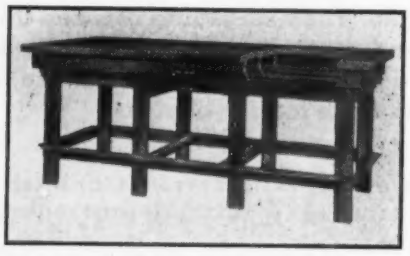
MOLY

device is power driven from the rear spindle of the machine. Overarm sleeves supplied with the standard geared milling head are available in 2, 2⅛ or 2¼ in. diameter, and in standard lengths up to 18 in. The head is supplied with one variable-speed pulley and a ¼, ⅜ or ¾ in. collet. The collet drawbar has a ½ in. bore to allow the tool shaft to run through if required. Cutter speeds up to 4,000 r.p.m. can be provided. The attachment weighs approximately 50 lb.

Whitcomb Quickcenter Machine Built to Center Round Bars

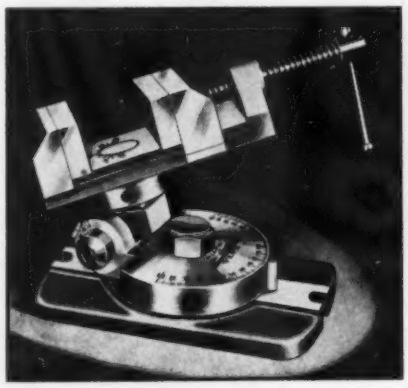
The Quickcenter machine, developed by Whitcomb Manufacturing Company, 476 Eighth St., Troy, N. Y., will center round bars from ½ to 3 in. in diameter. The bar is placed between self-centering jaws operated by a handwheel. The lower jaw has a V-block to receive the bar while the upper jaw is provided with a button that contacts the top of the work piece. When the bar is centered and clamped, the center drill is advanced with a lever.

The machine is operated by a ¼ hp. motor with three speeds available. Measurements of the Quickcenter machine are 23 X 13 in. by 49 in. high. It has a ½ in. drill chuck capacity. The unit weighs 400 lb.



Challenge Layout Plate Is Made With Clamp Edge

A semi-steel layout plate which has a clamp edge is being offered by Challenge Machinery Co., Grand Haven, Mich. The edge is machined on the bottom so that it is free from ribs, and permits the clamping of work to the surface top at any given point on any side of the plate. It is made in four sizes, 36X72, 40X96, 48X96, 48x128 in. and provides a true surface for layout, inspection or assembly work. The stand is equipped with lock leveling screws which enable quick leveling and secure locking.



Hilco All-Angle Vise Has Double Swivel Base

The Hilco all-angle Driv-Wheel Movement vise, made by Berco Manufacturing Co., 429 West Superior St., Chicago, Ill., is suited for grinders, drill presses, milling machines, magnetic chucks and for many other machine tools and bench uses. It is available in 3½, 4½ and 6 in. jaw widths.

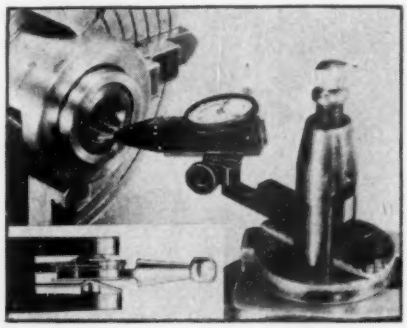
The vise is equipped with three protractor dials for horizontal, diagonal and 90 deg. vertical angular settings. The unit includes a drive-wheel motion which gives 2¾ in. lateral clearance. The double swivel construction permits any horizontal position, and right-angle clearance allows perpendicular position without base obstructions. The base has a 360-deg. swivel.

New England Line of Carbide Tools Includes Four Styles

Among the carbide-tipped flat and circular form tools, reamers, boring tools, counterbores, centers and special tools brought out by New England Carbide Tool Co., 60 Brookline St., Cambridge, Mass., there is a line of tungsten carbide-tipped single-point tools in four styles. The tools are both right- and left-hand, as well as pointed and square-tipped. They are furnished in U grade for cutting all materials except steel, and in S grade for cutting steel.

Testmaster Dial Indicator Has Locking Index Point

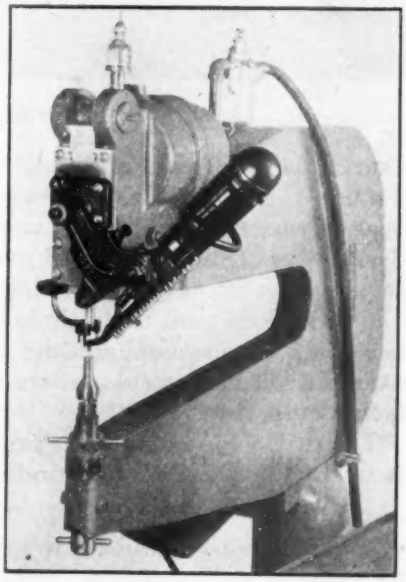
The Testmaster dial indicator introduced by Federal Products Corp., 1144 Eddy St., Providence, R. I., features a ratchet index point, which locks in place and will not come out unless re-



moved. It can be set at any angle within 180 deg. arc, and its direction of operation can be reversed. The point is chrome plated and its size permits use in recesses hard to reach.

The instrument is said to be extremely accurate, and is ruggedly built for production inspection, as well as being adaptable to many tests required in general machine shop and toolroom operations. Four models are available, two of which have metric graduations. The Testmaster is no larger than a person's thumb, and is furnished in a plastic case, complete with holding bar, clamp and instructions.

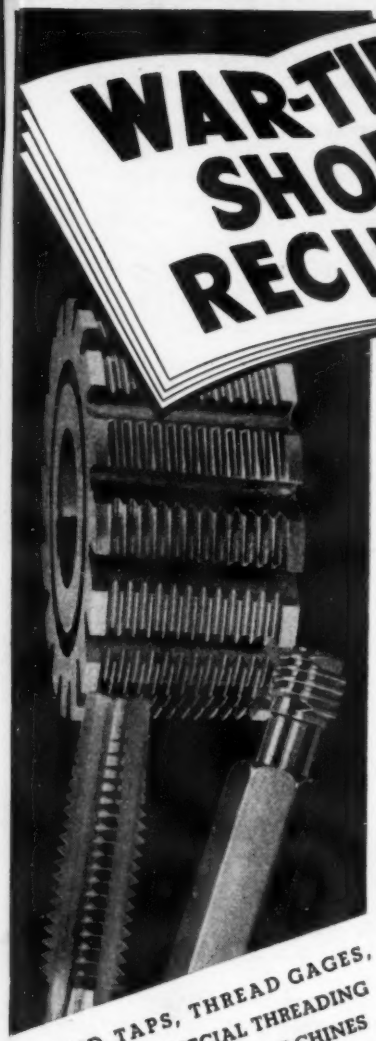
General Automatic Rivet Feeder Provides for Two Rivet Types



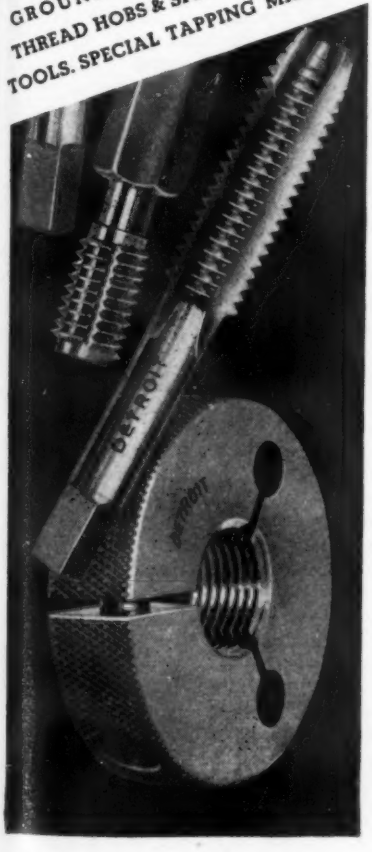
Model G-2500 quick-change rivet feeder, developed by General Engineering Co., 785 Hertel Ave., Buffalo, N. Y., is an accessory for the GBR type riveters. The feeder is suited for handling flat head AN 442 rivets and for 100 to 120 deg. countersunk rivets in sizes ranging from 3/32 to 3/16 in.

WAR-TIME SHOP RECIPES

#8 for thread production



GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES



Sometimes you WANT to break a Tap—

When tapping holes in costly machined parts, particularly bottoming holes where at times the material may run "tough" or have hard spots or where operators are less experienced, it is sometimes a good idea to cut a groove in your tap shanks so that the shank will break before the tap sticks and ruins the part. It will also ensure that your tap will break outside and not inside the hole for easier removal of the broken part.

"Detroit" taps themselves are tough and do not break easily. Most of the time that's an advantage. Once in a while it isn't and you might wish that they weren't quite as good as they are. Sometimes you *want* to break a tap.

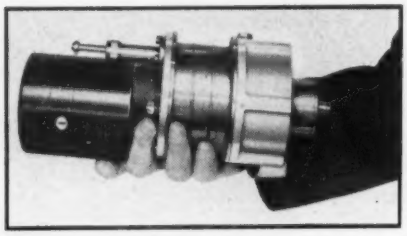
BUY U.S. BONDS STAMPS

DETROIT TAP & TOOL CO.

8432 BUTLER
DETROIT, 11
MICH. U.S.A.

Rivets are held in a hopper to one side of the upper ram and are fed to the work by a track assembly. As the riveting ram moves downward by pedal pressure, it kicks the rivet holding figures out of the way, leaving the rivet in the work. Continued downward motion of the ram heads the rivet in the usual manner. When the ram retracts, the next rivet is automatically brought into position.

For work which is too heavy to be conveniently raised onto the rivet, a pneumatically operated work raising sleeve is available for installation around the lower riveting anvil.



Graham Variable Speed Drive For Fractional-Hp. Motors

For application to motors of not more than 1/15 hp., the Model 15 midget variable-speed drive, made by Graham Transmissions Inc., 2706 North Teutonia Ave., Milwaukee, 6, Wis., offers a low power variable-speed transmission of wide range. The output speed range is from 700 r.p.m. to 0, or if it is desired to reverse the output shaft without reversing the motor, the range is from 400 forward to 400 r.p.m. reverse. Input speed is 3,600 r.p.m. for usual applications, or 1,800 r.p.m. for very low torque uses.

The over-all length including the input and output shaft extension of this drive is 7⅝ in., while the height from the base to the top of the motor is 4⅞ in. The unit is 4¾ in. deep with adjustable mounting legs. This speed drive is adaptable to manual control by hand-wheel with a speed indicating dial located at either side of the unit; by lever control; or other special controls to suit individual applications.

The Graham drive uses the compound planetary gear system except that the non-rotating member is a traction ring which engages two tapered rollers at varying diameters, the ring being moved lengthwise of the transmission to change the speed. The rollers are supported in a carrier which is connected to the motor shaft and are inclined at an angle equal to their taper, so that their outer edge is parallel to the central axis. Through the centrifugal force of the rollers, which remains constant since the carrier turns at constant motor speed, the required tractional pressure between rollers and rings is obtained. The rollers are pivoted in the carrier by a ball-joint mounting at their small end and are free to press outwardly against the ring under the centrifugal force.

Ruthman Gusher Coolant Pump Designed for Deeper Immersion

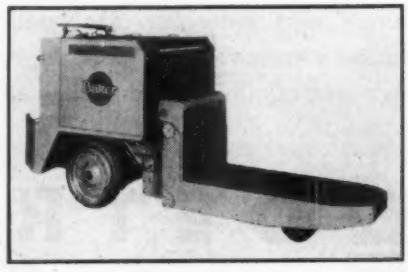
The gusher coolant pump made by Ruthman Machinery Co., 1810 Reading Road, Cincinnati, Ohio, has been developed for deeper immersion. This Model TL unit is capable of handling soluble coolants containing grit and abrasives without injuring the mechanism. The pump is available in two

lengths from the mounting flange to the bottom of the pump, one 23⅝ and the other 19⅝ in. It is equipped with a ½ hp. totally inclosed motor for continuous duty, and a ¾ hp. motor for extra heavy duty.

The pump, with greater immersion length, is provided with an integral mounted flange which is usually bolted to the reservoir cover or bedplate. This forms a simplified installation in connection with a comparatively deep reservoir which is frequently arranged below the floor level.

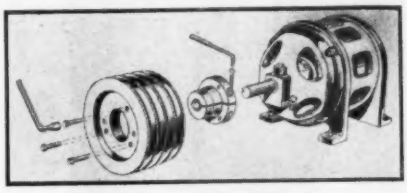
Baker Makes Low-Lift Truck With Separate Skid Platform

Baker Industrial Truck Div., Baker-Raulang Co., 2168 West 25 St., Cleveland, Ohio, has developed the Type E2 low-lift truck which will transport



4,000 lb. loads on a separate skid platform. This truck is built on a 66 in. wheelbase, and over-all length, including the operator's guard, is 123¾ in. It will make a right angle turn in an aisle 67 in. wide. The battery box size is 32 X 39½ in., providing space for enough additional battery capacity so that the truck may be operated continuously on the longer shifts. The vertical lift allows the handling of packages without damage by crushing between the battery compartment and load when lifting.

The unit features a Baker travel motor. All controls, together with the lift motor and pump, are in a convenient control panel, providing easy maintenance. Three speeds forward and reverse are provided in the truck.



Pyott V-Belt Drive Sheave Is Made for Easy Mounting

Pyott Foundry & Machine Co., 328 North Sangamon St., Chicago, Ill., has produced the QD (quick detachable) sheave in standard QD sizes for multiple V-belt drives. The sheave is applied or removed from either a driver or driven shaft by means of a socket wrench.

In attaching the sheave to the shaft the first step is to slip the tapered split hub onto the shaft in line with the keyway. Then the headless capscrew is tightened down with an inserted key, clamping the hub firmly on the shaft. Next the QD sheave is attached to the tapered hub and the pull-up bolts tightened.

Removal from the hub is accomplished by unscrewing the pull-up bolts and inserting two bolts in special tapped holes and tightening them down. As they emerge through the opposite side of the sheave, the pull-up screws act as jackscrews to force the sheave away from the hub.

Miccrostrip Made for Removal Of Coatings from Masked Parts

Miccrostrip, a solvent made by Michigan Chrome & Chemical Co., 6340 East Jefferson Ave., Detroit, Mich., is useful for the removal of the protective coatings produced by the company. It is intended for the removal of lacquer used to mask parts for hard chrome plating or for selective hardening. This material does not contain any acid, and is claimed not to affect any metal finish. It is also non-toxic.

Miccrostrip is a combination of solvents and is used entirely as a remover. This material is also suited for other Miccro coatings.

Solid rounds of alloy steel for 75mm. gun-barrels are pierced on a pipe mill by J & L skilled workmen.

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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

NEW PRODUCTION TEAM DELIVERS THE GUNS FOR VICTORY

The new 75mm. gun, descendant of the famous French 75 of World War I, is winning victorious acclaim in this war for and by our armed forces. This powerful weapon is one of the keystones in the teamwork our armed forces are employing on the fighting front to defeat the enemy.

Likewise on the industrial front it is teamwork that is producing these 75mm. gun-barrels at a fighting pace. The steel comes from a leading alloy steel manufacturer in the form of solid rounds eight feet long. At the Jones & Laughlin seamless tube mills, where oil country pipe is normally produced, these alloy steel rounds are heated and pierced their full length. Next steps are upsetting (forging) the breech end and heat-treating by a famous bearing manufacturer. Final stage is the machining and rifling by a New England machine tool company.

Four steps — four companies — each doing for Victory the thing best suited to its experience, skill and equipment. This is another example of war cooperation taking the place of competition in industry . . . of teamwork on the production fronts that matches the teamwork on the fighting fronts among our armed forces and those of our allies.

PITTSBURGH WORKS

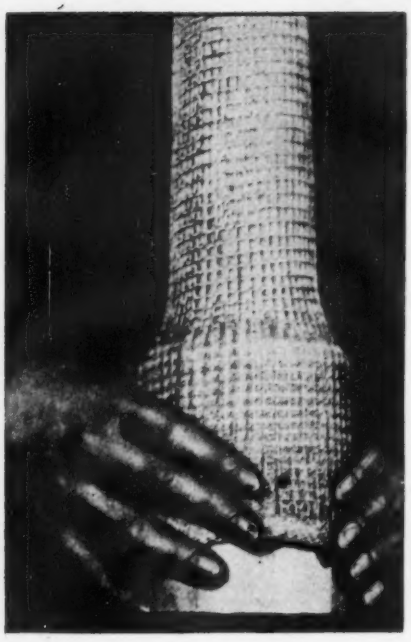
ALIQUIPPA WORKS

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL



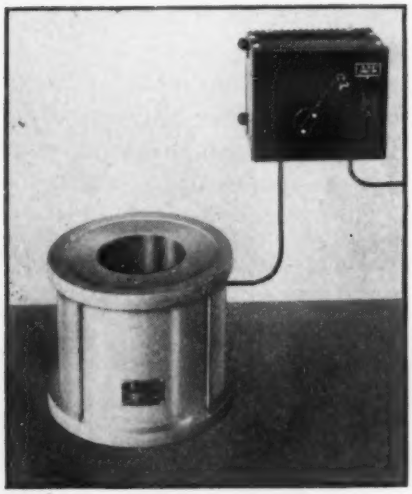
Metex Fragile Parts Jacket Protects Them in Process

The Metex protective boot, made by Metal Textile Corp., Orange, N. J., is suited for protecting superfinish and fragile parts in process and packing for shipment. This jacket or boot is made with an outside sleeve of composite steel and cotton mesh with an interlining of all cotton mesh. The boots will closely conform and cling to the contour of the parts. The Metex boot is available, custom made, in all diameters and lengths.

Cub Carburizing Furnace Used With Accelerated Salts

The Cub bench type carburizing furnace for toolroom use made by Lee Grinder Co., 4708 Armitage Ave., Chicago, Ill., has been designed for use with accelerated carburizing salts. It is 13⅝ in. in diameter and 11 in. high. The seamless, corrosion-resistant alloy pot is 6 in. deep and 6⅜ in. in diameter. The unit weighs 25 lb., and operates at a maximum temperature of 1,600 F. Regulation of the temperature for hardening carbon steel parts is provided by the control unit. This unit combines switch, magnetic circuit breaker and voltage control. The work is insulated from contact with the air.

The furnace can be operated intermittently or continuously on any 110-130 volt circuit. The salt is uniformly heated even when the level of the bath varies widely. Uniform temperature minimizes decomposition of the salts.

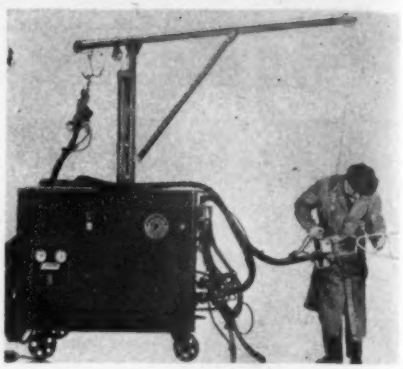


Eleco Machine Drive Control Eliminates Mechanical Methods

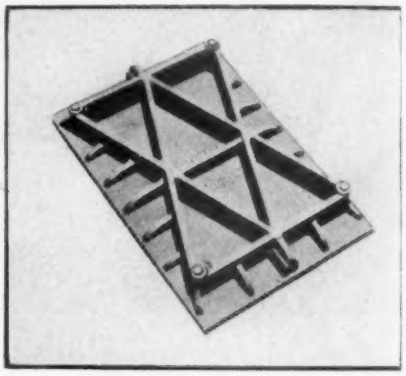
A shunt wound direct current motor can be connected to an alternating current line, for the purpose of obtaining adjustable machine speeds, by means of the Eleco RPM control made by the Electron Equipment Corp., Palm Springs, Calif. This rectifier control supplies the motor with ripple-free power, and its use is deemed not to cause armature heating or commutation difficulties. Close regulation is assured, regardless of change in load, at any speed selected. Stepless speed control is obtained, and a 20:1 speed ratio is permissible with armature control alone. These features are said to be useful in producing simplified machine tool drives.

Progressive Field Repair Cart Used for Spot-Welding Steel

For spot-welding of stainless and other light gage steels, Progressive Welder Co., 3001 East Outer Drive, Detroit, 12, Mich., has made a field repair cart. It is equipped with an electronic timer and a wide selection of both air operated and manual tong type guns. Refrigeration of transformers, cables, and guns eliminates the need for external water connections, the condenser in the Frostrode refrigerating unit being air cooled. The refrigerant in turn



circulates a low-temperature coolant through the transformer, cables and guns. Long cables of concentric kickless type are provided for power connection. The guns are so designed that a large variety of differently shaped electrodes may be mounted in them to reduce the number of guns to be carried on the cart.

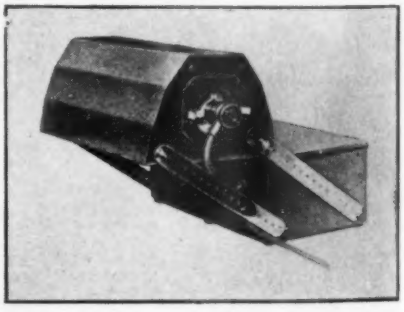


Stewart Surface Plates Feature Adjustable Feet

A surface plate with adjustable feet has been introduced by Stewart Co., 967 Farmington Ave., West Hartford, Conn. The plate is hard chromium plated and has deep oversize ribbing. The bearing points are planed and scraped, with three or four point bearing optional. This surface plate is available in two sizes, 10X15 and 12X18 in. The smaller weighs 48 lb. and the larger 68 lb.

Gates Inspection Light Permits Close Measurement

An inspection light which uses true monochromatic light source is made by George W. Gates & Co., Franklin



STEP TURNING...

3 times as fast!

MONARCH PERFORMANCE REPORT

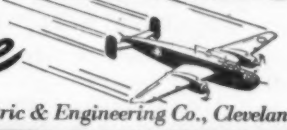
Lathe Size 18 x 48 BB- Automatic Sizing
Customer Reliance Elect. & Eng. Co.
Part Name Shaft
Material S.A.E. 1045
Heat Treat None
Operation Turn for grinding- Leave .020 Grind Stock
R. P. M. 420
Surf. Speed 275
Feed .015
Max. Depth of Cut 1/4"
Type Cutting Tool Carbide tipped

Actual Cutting Time 3.21 Min.
Load Time 4.46 Min.
Approx. Tool Life 55 Min.
Memorandum Foreman reports production 3 times as fast as on manually controlled lathes.

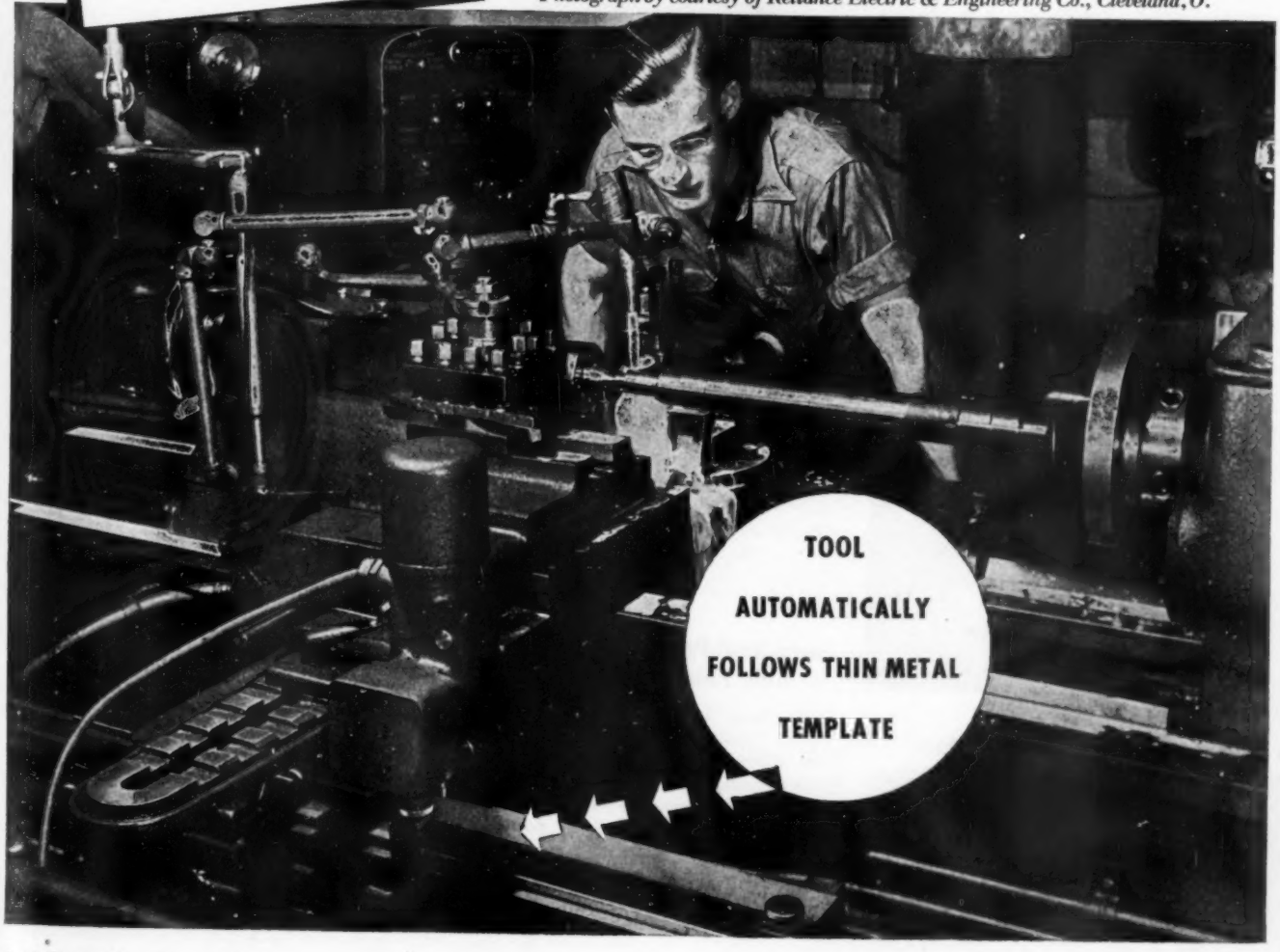
Turning the job illustrated is accomplished three times as fast on Monarch lathes equipped with automatic sizing, as was formerly done on standard lathes with manual control. It is typical of what can be accomplished on such work as turning, boring or facing or combinations of these operations. If you are interested in the application of Monarch's automatic sizing, to work in your plant, our engineers will gladly work with you.

THE MONARCH MACHINE TOOL COMPANY · SIDNEY · OHIO

MONARCH LATHES *Save Time*

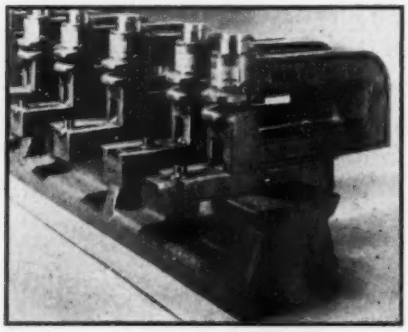


Photograph by courtesy of Reliance Electric & Engineering Co., Cleveland, O.



Square, Long Island, N. Y. This visual inspection unit is a useful means of creating interference bands in the checking of surfaces by means of optical gages.

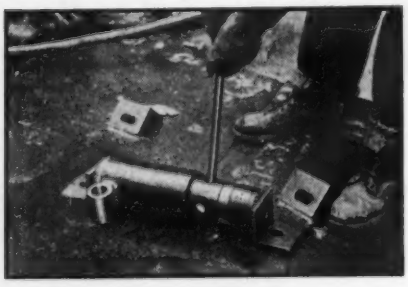
This monochromatic light requires no filters since it makes use of the monochromatic spectrum produced by a sodium vapor arc. Units are made in several different types, depending upon the application for which they are intended. In the bench model the reflector can be swung into various positions to direct illumination as desired over a wide or narrow field.



Wales Hole Punching Units Have Adjustable Adapters

For interchangeable use on either press brakes, rails, T-slotted plates and templets for punch presses, Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y., has brought out the Type B hole punching units with adjustable adapters. These adapters provide staggered as well as straight line hole punching patterns for punching holes in flat sheets. The maximum front to back adjustment of the adapters is 3 in. The hole punch units are also available with back stop rods 1⅜ in. center-to-center hole minimum and in throat depths up to 18 in.

Setups on T-slotted plates and templets are quickly made by bolting these units directly to the plate and templets in the exact position determined by the master pattern.



Simplex-Astin Shiplifters Jack Suited for Heavy Plate Setting

The Simplex-Astin shiplifters jack, built by Templeton, Kenly Co., 1020 South Central, Chicago, Ill., is suited for setting heavy deck plates for butt or lap weld joints. This jack has a capacity of 35 tons and exerts a direct push on the angle brackets which are tack-welded to the plates to insure quick and accurate plate alignment and aid proper weld deposit. Pressure is applied by an anchor which holds the jack firmly to the plate on which it is set. The unit is heavy-duty, bronze nut, ball thrust bearing screw jack and weighs 48 lb. without the lever bar.

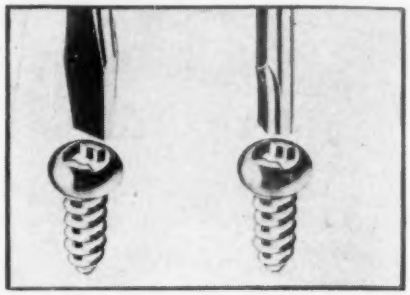
General Electric D. C. Motor For Low Thrust Applications

A line of d.c. vertical motors ranging from 40 to 200 hp. is being built by General Electric Co., Schenectady, N. Y. The motors are furnished for both constant and adjustable speeds, and designed for low thrust, solid shaft applications on pumps, machine tools, and marine underdeck auxiliaries.

The motor is drip-proof with convenient fittings on both the upper and lower bearings to simplify lubrication, and provision for the escape of excessive grease reduces the possibility of over-lubrication. A special bearing housing prevents grease from entering the motor. The cast iron conduit box can be arranged to bring the leads in at the top, bottom, or either side. Two hand-hole covers, which are removable without the use of tools, permit easy inspection of the commutator end brushes.

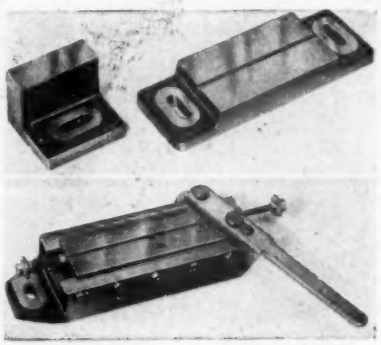
Turco Redi-Paint Compound Aids Paint Adhesion to Metal

Redi-Paint has been formulated by Turco Products, Inc., 6135 South Central Ave., Los Angeles, Calif., to provide a base for permanent paint adhesion on galvanized metal without chipping or peeling. This compound can be applied by hand or by tank immersion. A dark tint develops on the areas treated. The compound displaces the oily surface of galvanized metal with a rough surface to form a bond with the paint. It also neutralizes the alkaline property of the metal, forming an inactive film which is said to be resistant to corrosion.



United Clutch Head Screw Has Recessed Safety Head

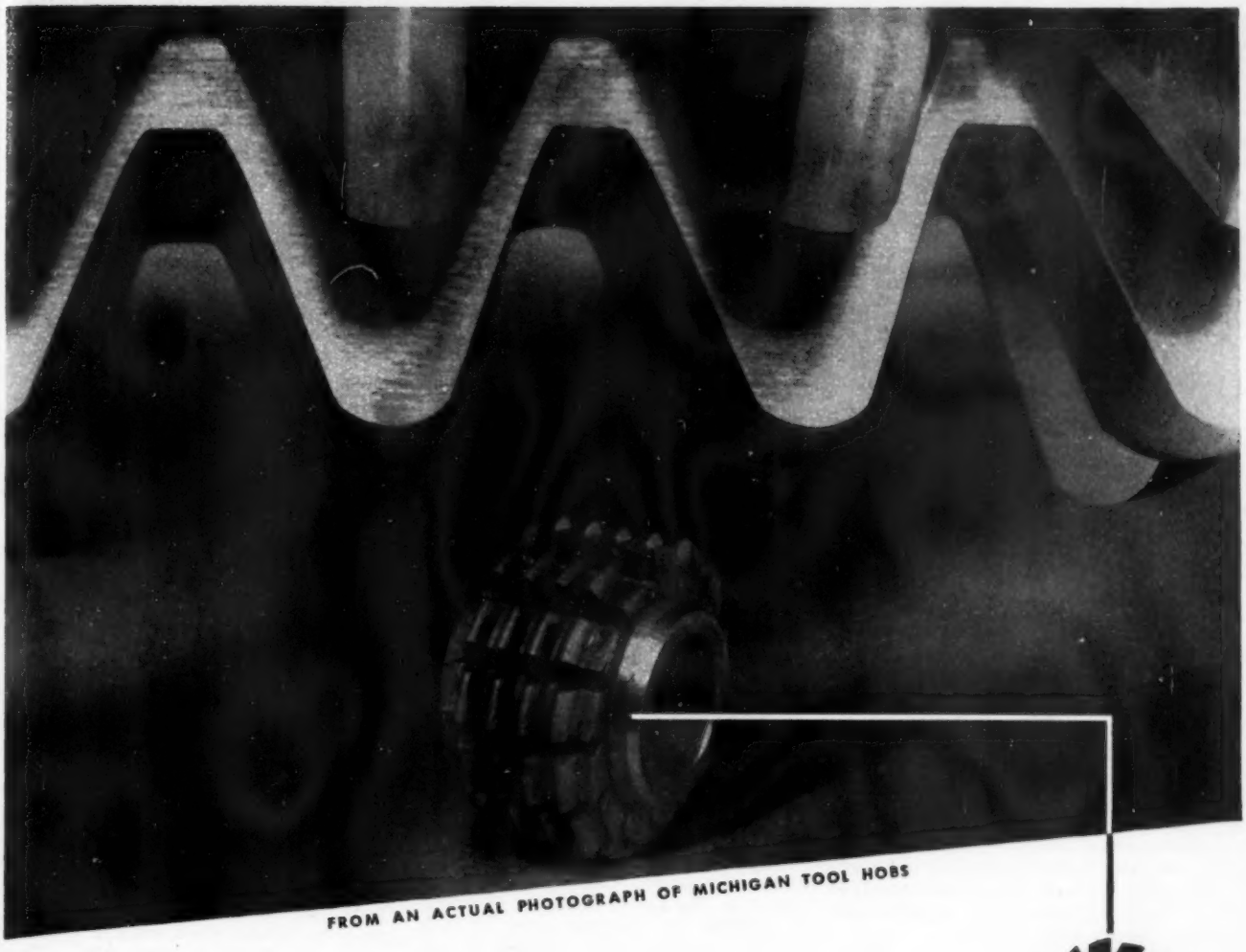
Clutch Head screws have been developed by United Screw & Bolt Corp., 2500 West Cullerton Ave., Chicago, Ill., which feature a recessed head made for operation with an assembly bit or with a standard type screwdriver. It is said that driver slippage has been eliminated, and the entry of the assembly bit is self-centering for safety and speed when being driven. Clutch Head screws are available in a wide range of head designs. With a slight reverse movement of the driver, the screw and driver bit are united, and the driver remains in position until the power of driving automatically releases this positive frictional lock.



Rouse Fixture Set-Ups For Use on Hand Miller

Several fixture set-ups have been made available by H. B. Rouse & Co., 2214-16 North Wayne Ave., Chicago, Ill., for use on the company's hand miller to eliminate the need of preliminary tooling. The angle plate set-up has a 3/16 in. keyway on the bottom surface, while the flat set-up has a 3/16 in. keyway on the bottom and on the top, giving adjustment from front to back and sideways.

The stationary baseplate with sliding table has a 3/16 in. keyway on the bottom. The sliding table has adjustable stops at both ends and a movement of 3½ in. with a lever feed, with movement adjustable from left to right.



FROM AN ACTUAL PHOTOGRAPH OF MICHIGAN TOOL HOBS

Actual Size

IF HOBS COULD TALK.....

GOLIATH: Hello, small fry, where did you come from?

DAVID: Same place you did — Michigan Tool Company. And don't call me small fry. Even if I am only a ¾ incher, I'm doing just as man size a job as you are.

GOLIATH: Piffle, infant. Why—you know what I do? I cut the teeth in battleship turbine reduction gears that run 8 ft. across or more.

DAVID: Just a 'hogger'!! Why, listen—I've got the iob of cutting teeth on fine instrument gears and they've got to be held to less than two tenths of a thousandth.

GOLIATH: Hey, wait a minute. Just because I'm in the big time, doesn't mean that I'm not there to the last decimal. I'm streamlined, I am — ground all over, just like you.

DAVID: That's all right, big fellow, I wasn't trying to belittle you. After all we belong to the same family and we're both doing the best job we know how.

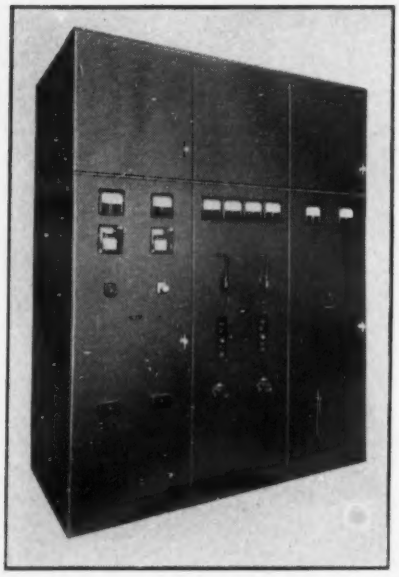
GOLIATH: Yep, they *do* say that about Michigan hobs, don't they?

. . . and if you want to help your hobs do a still better job, write for a copy of "Hobbing". Ask for Booklet No. 149 A.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD • DETROIT 12, U. S. A.

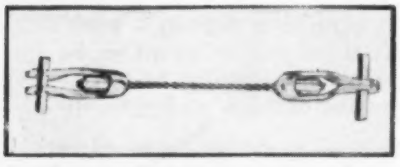
BUY U.S. BONDS STAMPS



Allis-Chalmers Motor Starter Suits Special Application

For full or reduced voltage starting, dynamic braking, reversing and special applications, Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has developed the Type H motor starter for both induction and synchronous type motors rated up to 1,000 hp. at 2,300 volts, and 1,750 hp. and 4,600 volts 3-phase, 60 or 50 cycles. The starter is a metal-inclosed structure, and high interrupting capacity disconnecting type fuses are utilized in combination with a heavy-duty oil switch.

Short circuit protection up to 160,000 kva. at 2,300 volts, and 320,000 kva. at 4,600 volts eliminates the need for a back-up breaker within these ratings. Disconnecting type fuses combining high interrupting capacity with fast-clearing action hold short circuit currents to safe values which do not damage the control. The fuses operate only under actual short-circuit conditions and do not blow out unnecessarily. This starter protects motors from sustained overloads, locked rotor condition, single phasing and overloading caused by too frequent starting by means of thermal overload relay accurately calibrated.



Socketype Cable Terminals Fit Fork or Eye Type Sockets

The Socketype cable terminal, produced by Poulsen & Nardon, Inc., 2665 Leonis Blvd., Los Angeles, Calif., is available in both fork and eye types to fit 1/16, 3-32, ⅛, 5-32, 3-16 in. and larger cables. These terminals are interchangeable with B and C types of present AN and NAF designs in aircraft, automotive, ordnance and marine fields, and are stamped from alloy steel and cadium plated.

The small cable-ends of this terminal may be quickly fitted on the cable end, and swaging dies need not be removed from the machine.

Cunningham Sleeve Holder Marks on Round Pieces

For marking on small round and square pieces, M. E. Cunningham Co., 95 East Carson St., Pittsburgh, Pa., has a safety sleeve holder that can be made with any size or number of characters. The outside frame is made of alloy

steel and the legs are grooved for use on small rounds. The top section surrounding the shank of the type holder is knurled for positive grip. A pin for quick-change of steel type inserts retains the holder in place. This type holder is made of special steel with safety features of non-spalling and non-mushrooming.

Grayson-Kennametal Cutters Available in Three Grades

McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa., is making Grayson-Kennametal milling cutters with bodies of Meehanite and tipped with Kennametal. These cutters, employing double negative rake angles, are available in grade KM for milling steel, and with positive rake angles in grade K2S for rough milling of cast iron, or grade K4H for milling aluminum-silicon alloys, magnesium-aluminum alloys, brass, bronze, and most other nonferrous metals.

Stoody Hard-Facing Alloy Rods for Oxyacetylene Welding

Stoody Co., Whittier, Calif., has developed Stoody 1 and 6 hard-facing alloys of cobalt, chromium and tungsten, which are furnished as welding rods for application by the oxyacetylene process.

Stoody 1, the harder of the two alloys, provides high resistance to abrasion, corrosion and heat. It is recommended especially for hard-facing pump sleeves, wire guides, expeller parts, and similar types of equipment.

Stoody 6, which is not quite as hard as the other alloy, is more ductile and provides considerably greater resistance to impact. It is useful for hard-facing high pressure, high temperature valves, various types of dies, shear blades, cams, gasoline and diesel exhaust valves.

Both of these hard-facing alloys are furnished in ⅛, 3/16, 5/16, and ⅜ in. rod diameters and rod lengths of 14 in.

Crucible Introduces Rex MMM Having Higher Cobalt Content

Rex MMM high-speed steel is being offered by Crucible Steel Company of America, 405 Lexington Ave., New York, N. Y. It is a molybdenum-tungsten-cobalt steel with 5 percent more cobalt than Rex MM. This addition produces a steel with superior hardness, resistance to abrasive wear and extreme red hardness and makes it particularly adaptable for continuous cutting on abrasive materials that develop high frictional temperatures.

The hardness of Rex MMM, after hardening 2,200 to 2,225 F. and tempering at various temperatures, is as follows:

		Rockwell C Hardness
As quenched in oil.		63/65
Double tempered 2 hr. plus 2 hr.	1025 F.	65/67
	1050	64/66
	1075	64/66
	1100	63.5/65.5
	1125	62.5/64.5
	1150	60/63

NEW MATERIALS

du Pont Nylon Plastic Has High Softening Point

E. I. du Pont de Nemours & Co., Wilmington, Del., has developed nylon plastic which will be available after the war but is now restricted to military use. This material is a thermal plastic with softening point of 450 F.

How to stop a war ...*like that!*

FRICTION can stop anything
Even a war.
Especially *this* war, mechanized as it is to an almost incredible degree.

Take away a certain anti-friction device—
and the greatest war machine we have ever faced
would soon grind to a *permanent* stop.

Take away anti-friction bearings—and not only
the *tools* of war, but the machines which *make*
these tools of war would shortly become
so much scrap.

UNFORTUNATELY, we are *not yet* able to do this.
But in the field of anti-friction bearings—as in other fields
—we are steadily *out-producing* our enemies.

Before bombs dropped at Pearl Harbor,
NEW DEPARTURE was the world's largest producer
of ball bearings . . . now it has a major
responsibility in the ball bearing war program.

NEW DEPARTURE - DIVISION OF GENERAL MOTORS - BRISTOL, CONNECTICUT

3187

Nothing rolls like a ball

New Departure

THE FORGED STEEL BEARING

LUFKIN "ANCHOR"

CHROME CLAD STEEL TAPE

Jet black markings on this Lufkin "Anchor" Chrome Clad Steel Tape are easy to read, even in poor light. Satin chrome finish won't rust, crack, chip or peel.

EASY TO READ MARKINGS THAT ARE DURABLE

Everyone who appreciates mechanical quality likes the Lufkin "Anchor" Chrome Clad Steel Tape. Suitable for all measuring work, this sturdy tape is available in lengths from 25 to 100 feet and marked in feet, inches and eighths or feet, tenths and hundredths. Case is of finest, genuine mahogany-colored leather, closely hand-stitched over a substantial, steel liner. Folding flush handle opens by a push pin. Write for free catalog.

BUY THROUGH YOUR DISTRIBUTOR

LUFKIN

SAGINAW, MICHIGAN · NEW YORK CITY

TAPES · RULES · PRECISION TOOLS

The toughness of nylon plastic is particularly useful where thin sections with great strength are required. It is one of the lightest plastics in weight, burns slowly, and is said to undergo little or no deterioration with age. This material is only slightly affected by sunlight, resists oil, grease, solvents and alkalis, and is easily machined.

Durez Resin Can Be Prepared For Low Temperature Casting

A resin can be prepared for casting at low temperatures by the use of 7421 Durez liquid resin, which is made by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., and the addition of its 7422 accelerator. Among the uses for this resin are its application for dies in the aircraft industry. The cast product has the following physical properties:

Compressive strength, 15,000 to 20,000 lb. per sq. in.

Impact strength (energy to break one-half by one-half-in. bar), 0.11-0.15 ft. lb. Izod

Flexural Strength, 7,000-9,000 lb. per sq. in.

Modulus of Elasticity (in bending), 500,000

The 7421 liquid resin is a thermosetting material and can be set by baking at temperatures above 100 C., while 7422 accelerates the set so that castings can be made at lower temperatures in a reasonable length of time. This accelerator is an acidic material and loses its effectiveness if used in conjunction with any substance which absorbs acid. It changes the color of 7421 resin from a reddish brown to a pale yellow.

Before pouring, the mixed batch should stand from 15 to 30 min. to eliminate bubbles. As the resin sets, it becomes opaque and gelatinous in form and finally takes on a creamy appearance as it reaches final hardness. Eight hours are required for baking small castings at 160 F.

TRADE PUBLICATIONS

AIR CLEANING "Aiding War Production with Clean, Dry Air," is the title and subject matter of a new 8-page bulletin, No. 543, released by the Logan Engineering Co., 4900 Lawrence Ave., Chicago, Ill. The operation of the Aridifier, made by that company, is pictured and described in detail, along with illustrations and explanation of its application to compressed air lines in various types of plants.

BEARINGS Keystone Carbon Co., Saint Marys, Pa., has released lists containing pertinent information on Selflube Porous Bronze Bearings carried in stock and available for immediate delivery. An up-to-date stock

list will be issued every six or eight weeks. Names will be placed on the mailing list by request for data sheets.

CEILING PRICES A booklet listing new prices as of March 1, 1941, for all of the types and sizes of machine tools made by 185 manufacturers, which will be utilized by used machine dealers for determining ceiling prices on old equipment, is being issued by the Office of Price Administration, Washington, D. C.

CUTTERS Gallmeyer & Livingston Co., Grand Rapids, Mich., has issued a booklet describing "Grand Rapids Universal Cutter and Tool Grinders—Showing Numbers 4 and 5."

DEEP HOLE BORING Circular 445, "Two-Spindle Deep Hole Cylinder Boring Machine," is available from the W. F. and John Barnes Co., Rockford, Ill. Pictures, descriptions and statistics pertinent to the machine are furnished in the circular.

DUPLICATING "What is Duplimatic and How Does it Work," is the title and subject of a 16-page, 3-color broadside showing a sectional view of the automatic machine tool control manufactured by the Detroit Universal Duplicator Co., Detroit, Mich.

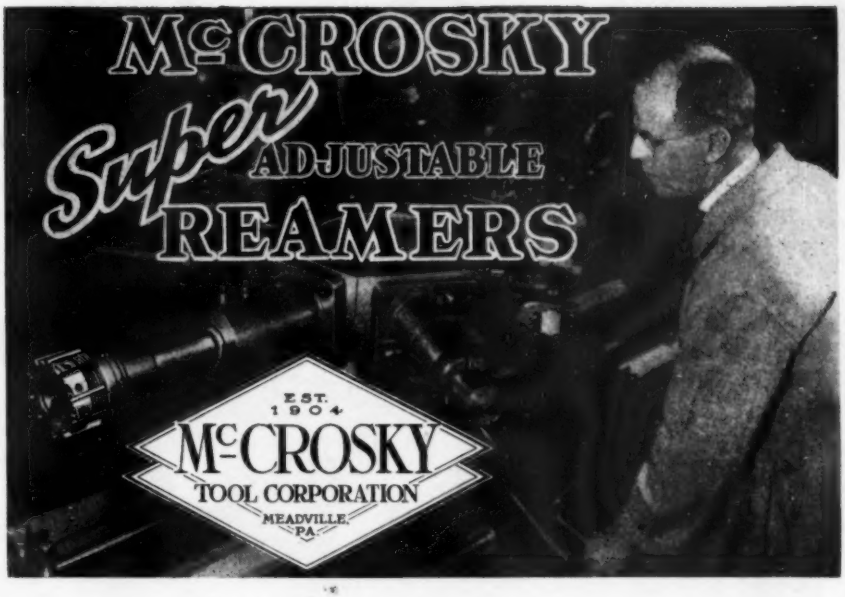
ELECTRONICS The fundamental principles of the six basic ways in which electronic tubes function are explained in a new 36-page booklet, B-3260, announced by Department 7-N-20, Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

FIRE FIGHTING Walter Kidde & Co., Belleville, N. J., offers a 36-page illustrated manual, designed to serve as an easy reference on the subject of first-aid fire fighting. It describes and illustrates the fundamental facts about fires and their control. All the usual varieties of extinguishers are covered and brief but explicit directions given for their use.

GRINDERS "Grand Rapids (Hand Feed) Surface Grinders" is the title and subject of a folder issued by Gallmeyer & Livingston Co., Grand Rapids, Mich., giving pictures and specifications of its Nos. 15 and 0 machines.

GRINDING Bulletin No. 502, has been issued by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo 54 F, Mich., illustrating that manufacturer's cylindrical grinding, polishing and buffing machines. It gives detailed information for finishing of ¼ to 9 in. outside diamete. tubes, rubs, bars and a wide variety of cylindrical shapes.

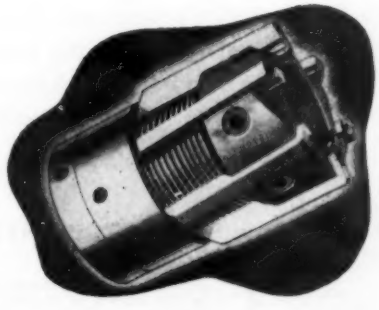
HEAT CONTROL Bulletin No. BF-1, giving specifications and detail drawings of its "Control System for Hot



DO YOU

have a copy of the McCrosky Reamer Manual? This simple, 20-page, illustrated handbook covers the basic principles of the inserted-blade reamer, the fundamentals of reamer grinding and maintenance—information that will help you maintain top production if you are using a McCrosky Super Adjustable Reamer.

Also available are the McCrosky Boring Bar Manual, the McCrosky Quick-Change Chuck Manual, and various bulletins and engineering data sheets covering all units in the McCrosky line of Cost Cutting Tools. Write to McCrosky, Meadville, Pa.



McCROSKY COST CUTTING TOOLS

◆ SUPER ADJUSTABLE REAMERS ◆ ADJUSTABLE BORING BARS
◆ JACK-LOCK MILLING CUTTERS ◆ WIZARD CHUCKS ◆ TURRET TOOL POSTS

THE *Strategy* OF MAN-POWER

RELIEVING VITAL MAN-POWER of unnecessary fatigue . . . avoiding unnecessary handling . . . saving unnecessary steps . . . keeping a constant flow of material moving to waiting hands and machines, that's man-power strategy headed towards victory.

America's war industries from coast to coast are improving their per-man-and-machine-hour production schedules with the aid of Mathews Time-Coordinated Conveyer Systems.

MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION

If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

MATHEWS CONVEYER COMPANY ELLWOOD CITY PENNSYLVANIA

Blast Temperatures for Control of Both Mixing and Cold Blast Valves," is available from The Brown Instrument Co., Division of Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.

HOT WORK STEEL A folder describing its "Pure Ore D-C-33 Hot Work Steel" has been issued by Kloster Steel Corp., 224-228 N. Justine St., Chicago, Ill. Described and illustrated are the various uses of the steel.

HYDRAULIC CONTROL Bulletin 78-D, describing Exactor Hydraulic Control, manufactured by Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J., is available from the producer. Details of its use and possible applications are described and pictured, while diagrammatic sketches give details of dimensions.

HYDRAULIC CYLINDERS Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has announced publication of a 32-page catalog giving information on its line of hydraulic cylinders in detail, making possible quick selection for a specific application. It is available to anyone writing for it on his company letterhead.

IDENTIFICATION EMBLEMS A bulletin on "War Industrial Identification Emblems" has been issued by Royal Emblem Co., 41 John St., New York, N. Y. Printed in two colors and illustrated, it covers plastic, acetate, celluloid, metal and felt badges, emblems, pins and buttons.

LATHES Catalog No. 901, issued by the South Bend Lathe Works, South Bend, Ind., describes and illustrates the lathes available in series 900 and 1,000 designed for the high-speed machining of small chucking and bar work requiring close tolerances.

METAL FINISHING For drying, baking and heating processes, radiant heat drying lamps are recommended in a new illustrated booklet announced by Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. The 12-page booklet tells what radian heat is, and discusses its advantages, gives details of the design and performance characteristics of the drying lamp, and arrangement of equipment and electrical circuit design.

MILLING MACHINES Jefferson Machine Tool Co., Fourth, Cutter and Sweeney Sts., Cincinnati, Ohio, has issued a catalog describing, pricing and picturing its line of "Bulldog" precision milling machines and attachments, conversion attachments for lathes, endless belt sanding machine, swing frame grinding and polishing machine and gyratory foundry riddle.

MOTOR CONTROL The Trumbull Electric Mfg. Co., Plainville, Conn., has issued a circular describing and

Five Brothers*..

..and an Idea

IT ISN'T OFTEN that an idea created in the minds of boys will materialize in later life. With the five Turner brothers, William, Cort, Frank, Charles, and Robert, their boyhood idea that some day they would be in business together, overshadowed all the obstacles of hard work, and study to make this idea a reality. ★ Finally in April 1939 they purchased their first grinding machine and formed their own company. From this modest beginning they gradually won recognition among manufacturers for precision-built gauges. This recognition made expansion necessary, and today their company occupies one of the most modern buildings for the manufacture of gauges in the country. ★ The ℄ stamped on a gauge represents a product backed by the integrity of five brothers and their practical knowledge of precision gauges.

**Since May 7, 1942, William Turner, of the U. S. Navy, has been reported missing in action in the Coral Sea Battle.*

The Stamp ℄ of Precision

TURNER GAUGE GRINDING COMPANY

2628 HILTON ROAD . . FERNDALE, MICHIGAN

illustrating its line of control centers, including motor and switchboard control centers.

PRECISION MACHINERY Acme Industrial Co., Dept. A.M., 200 N. Laflin St., Chicago, Ill., recently published a booklet describing the uses of light wave measuring equipment. The booklet contains various descriptive charts, illustrations, diagrams and detailed instructions. The Acme Organization claims that any mechanic can measure in millionths of an inch by following the instructions outlined in the new booklet.

SEED MONEY "Seed Money and What It Means to You" is a primer, prepared by McGraw-Hill Publishing Co., 330 West 42d St., New York, N. Y., devoted to the explanation of that company's "Seed Money" campaign. It reprints eleven of the advertisements that have appeared, and an insert shows examples of how American business is spreading the "Seed Money" gospel in local newspapers, house organs and editorial pages.

SINE CHECKING EQUIPMENT Ready for mailing to those making qualified requests on firm letterheads, is a new pocket-size, 20-page booklet on the sine checking equipment manufactured by The Taft-Pierce Mfg. Co., Woonsocket, R. I. The booklet also includes instructions on the application charts, is announced by West- tables of Constants for the 5 in. sine bar, together with conversion factors.

SOCKET WRENCHES The importance of modern socket wrenches is emphasized by a booklet offered to wrench users and buyers, "Meet the Mechlins," published by Blackhawk Mfg. Co., Milwaukee 1, Wis. The booklet gives information on the advantages of modern socket wrenches, along with suggestions for prolonging the life of all small hand tools.

SOUTHERN INDUSTRY A booklet published by the Lewis Supply Co., Memphis, Tenn., "Industry to Bloom in Dixie," describes the postwar possibilities of the South for industrial development.

STOKERS To help keep single retort stokers on the job, a new operating guide, containing operating and maintenance suggestions and inspection of the sine bar, and gives full inghouse Electric and Mfg. Co., East Pittsburgh, Pa. A copy of this booklet, B-3257, may be secured from Dept. 7-N-20, at the afore-stated address.

SURFACE GRINDERS The Hill Acme Co., 6400 Breakwater Ave., Cleveland 2, Ohio, offers Bulletin H-V-3 describing its line of heavy duty precision surface grinders, manufactured in both the vertical spindle and horizontal spindle design, and in table sizes 18, 24, 30 and 36 in. and wider, and 5 ft. to 20 ft. long.

W-S Standard Reamers with carbide tips. Tapered shank (illustrated) and straight shank types. Sizes: ¼ to 1½.

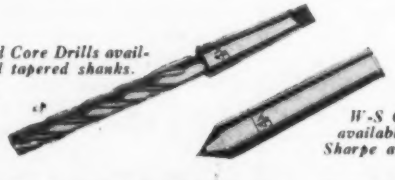
STANDARD CUTTERS
available from stock

REAMERS and many other cutting tools formerly in the "special" class are now STANDARD with us. The majority of these STANDARD cutters is in stock *most of the time*. Our broad line often enables the consolidation of tool orders and saving of valuable time. Each W-S tool is genuine CARBOLOY tipped. The grade used is the one best suited to do a cutting job on the metals for which the tool was ordered. (Other brands of carbide can be specified.)

Carbide tipped tools are not just a specialty with us . . . we make them *exclusively*. You can *expect* and *get* uniform, high quality results with W-S tools. Write for new FREE Catalog 942 and latest prices. WENDT-SONIS COMPANY, HANNIBAL, MISSOURI.

SAVE TIME . . . wire or phone your requirements!

W-S Carbide Tipped Core Drills available in straight and tapered shanks. Sizes: ½ to 1½.



W-S Carbide Tipped Centers available in Morse, Browne & Sharpe and Jarno Tapers.

WENDT-SONIS

CARBOLOY CUTTING TOOLS

CENTERS ★ DRILLS ★ CORE DRILLS ★ COUNTERBORES ★ SPOT FACERS
END MILLS ★ REAMERS ★ HOLLOW MILLS ★ LATHE BITS ★ SPECIAL TOOLS

SURFACE PLATES A circular issued by the Stewart Co., 967 Farmington Ave., West Hartford, Conn., describes that firm's "Hartford" surface plates, gives specifications, pictures and prices.

TEMPERATURE CONTROL The Brown Instrument Company, Wayne & Roberts Aves., Philadelphia, Pa., has issued Bulletin 87-1, entitled, "Brown New-Matic Time-Pattern Controller." The publication describes in detail the operating principles of the company's time-pattern controller, along with diagrams and illustrations of installations.

TOOL CONSERVATION Bulletin No. 531 of the Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich., is entitled "Here's How to Know How—on Gear Cutting Tool Conservation." Included are "15 ways to get more out of shaper cutters," "15 ways to get more out of hobs," and "Do's and Dont's in Hobbing Worm Gears."

TOOL STEEL Copperweld Steel Co., Warren, Ohio, has published a 48-page "Handbook on Coppco Tool Steels." Feature of the book is a section on the descriptions, working suggestions, and demonstration photographs for the ten Coppco Tool Steels. Included is a shop chart listing more than 70 common tool applications and recommendation for selection of the proper steel.

TUBE FITTINGS Cotner-Wilkinson Company, Logansport, Ind., has released a 60-page, four color, illustrated catalog (No. 43), giving complete sizes, specifications and prices on all models of "Collet Grip" tube fittings. It also contains information on tube benders, flaring tools, hose couplings, adapters and steel tubing, and convenient tables on working pressures for steel tubing.

VALVES A 4-page illustrated Bulletin, No. 16-B, containing complete dimension tables for butterfly valves, 15 to 125 psi, has been issued by R-S Products Corp., Wayne Junction, Philadelphia, Pa. It features valves for regulation and shut-off duty for air, gas, steam, liquids and semi-solids, under both manual and automatic control.

VISE Berco Mfg. Co., 429 West Superior Street, Chicago, Ill., has issued a pamphlet describing "Hilco All-Angle Driv-Wheel Movement Vise in Three Sizes." The equipment is described, pictured and priced.

WELDING A chart prepared by Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y., contains in clear, concise form, all details relative to the low temperature welding alloys.

WELDING A data service in loose leaf form, "Practical Design for Arc Welding," is being released by The Hobart Brothers Co., Troy, Ohio. It is designed to be readily adaptable to the individual users file preference. The first series is being released at no charge.

NEW BOOKS

AIRCRAFT POWER PLANTS—*By Arthur P. Frass, instructor in aircraft engines, Daniel Guggenheim School of Aeronautics, College of Engineering, New York University.* 472 *pages. Published by McGraw-Hill Book Company,* 330 *West* 42*nd Street, New York, N. Y.* $4.50.

The increased complexity of engineering problems involved in aircraft-engine testing, installation, operation and maintenance, coupled with the rapid growth of the aircraft industry, has created a widespread demand for an aircraft power-plant book for engineers. This volume is intended to meet that need.

The method of presentation and the material included have been based on experience gained in teaching courses in this subject to classes of U.S. Army and Navy officers, senior and graduate students in aeronautical engineering, and engineers actively engaged in the industry. The aim of the book is to present fundamental terms that will give the reader a good background of information on all phases of the subject. In most cases, there are a considerable number of books or technical papers in the literature that treat particular items much more thoroughly. Those which have seemed most directly useful to the student have been listed in the references at the end of each chapter.

Since the book is designed primarily to fit the needs of engineering college seniors and of graduate engineers in the armed services or the aircraft industry, it is assumed that the reader is familiar with college physics, thermodynamics and fluid mechanics. The effort has been made to make the treatment as simple as the subject permits. Wherever possible, test results have been included to substantiate important points. Widely used empirical rules and formulas have been included where they seemed appropriate.

SEEN and HEARD

Stenciled Apologies

After commenting, somewhat sarcastically, about the use of a brass plate to call attention to the saving by the use of the new "war" finish on machine tools, I want to hand a bouquet to the Gisholt Company for a real saving spirit. I recently saw one of their expensive machines in "war paint" with the notice as to the reason for departing from their old time quality put on in white paint with a stencil—no waste of critical material or of manpower. A cheaply made stencil, a little white paint, and the newest office boy or helper to wield it, and the job was done. What could be more efficient?

WOODY SPENCER SAYS:—

"SHARPEN TAPS CORRECTLY"

No. 5 in a series of WOOD & SPENCER "KNOW HOW" messages.

To insure accurate results a tap must not only be sharp — it must be sharpened correctly!

For example:

1. If a tap is cutting too small the teeth should be ground so that there is a little less "hook" on the cutting edges.
2. For best results, sharpen taps on a tap-grinding machine.
3. When sharpening taps on a grinder take light cuts. Otherwise the threads will be burned.
4. If it is necessary to sharpen taps by hand, use the proper grain wheel.

The above tips have been designed to act as "reminders" for you. However, if you have tapping problems requiring technical information, write to us. From customers' blueprints we quite frequently make recommendations for

"THE RIGHT TAP AT THE RIGHT TIME"

The Wood & Spencer Company

Cleveland, Ohio

The Young Men Know Their Engines

AMERICAN built planes are carrying on along the Mediterranean and in the South Pacific.

Skillful American Pilots, serviced by skilled ground crews, are steadily shoving the Nazi and the Jap back to defeat.

These young Americans are living up to the tradition that made this country prosperous and great.

Fenn precision built parts go into the construction of many planes, ships, tanks — wherever the demand is for special machinery and parts made to accurate measurements.

Fenn acts as prime contractor or sub-contractor on special machinery, parts and equipment. We welcome inquiries from those who need assistance in either developmental work or actual production.

FENN

THE FENN MFG. CO.
HARTFORD, CONN.
ESTABLISHED 1900

Free Wheeling

Some of our new aircraft plants have such vast floor areas that it's hard to get around without using a lot of time and corn plaster. Like most everything else in these plants, the tendency is to mechanize. Motor scooters are common; most of them have a side car so visitors may be shown around without exhaustion. Bicycles, permitted in many plants, help speed foremen and supervisors through their appointed rounds. Other plants encourage the use of roller skates. Messengers and stock chasers dart in and out between wing fixtures and fuselage assemblies. Some acquire a grace and skill that rival the Henie technique.

High Frequency Induction Heat Saves Time and Skill

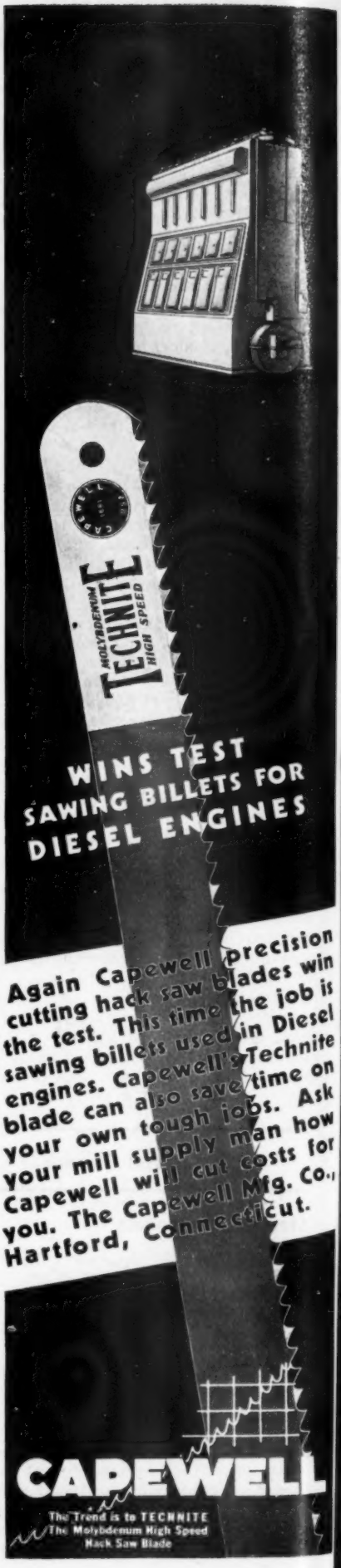
BY J. P. JORDAN, G. E. RADIO TELEVISION AND ELECTRONICS DEPT.

High frequency induction heat, used in a brazing operation on certain parts for war goods being produced at a General Electric plant in the east, has reduced the time for the operation from 4 min. to 40 sec., and has eliminated the need for highly skilled workers to perform the work.

The brazing operation was previously done with torches. Because a high quality joint was needed, only highly skilled workers could be used. Great care had to be taken not only during the operation, but also in its inspection. The average time per joint was about 4 min. With the application of electronic high frequency induction heat, the time required for the operation has been reduced to 40 sec. Women operators are now used, a uniform joint is achieved and, because of uniformity, inspection of this operation is eliminated.

There are many brazing and soldering operations now performed by other methods which could be done faster and better by high frequency induction heat.

Induction heat can best be explained by likening it to the radiant heat from the sun: the sun's rays pass through space with little loss, yet when they strike a dark body the surface is heated. In like manner, the high frequency pulsating magnetic waves, radiated from the induction heater coil, pass through all insulating materials with little loss, yet create heat when they strike any metallic body. In use, the part to be heated is placed in a water-cooled, copper tubing coil and current is passed through the coil at frequencies in the order of 500,000 cycles per second. This current generates the pulsating magnetic field which heats the part. The intervening air, or parts of the human body which may be in the magnetic field, are not affected.


MOLYBDENUM
TECHNITE
HIGH SPEED
WINS TEST
SAWING BILLETS FOR
DIESEL ENGINES
Again Capewell precision cutting hack saw blades win the test. This time the job is sawing billets used in Diesel engines. Capewell's Technite blade can also save time on your own tough jobs. Ask your mill supply man how Capewell will cut costs for you. The Capewell Mfg. Co., Hartford, Connecticut.
CAPEWELL
The Trend is to TECHNITE
The Molybdenum High Speed
Hack Saw Blade

A lack of experience need not reduce inspection precision

It does require both skill and experience to handle close tolerance work on the time-honored fixed size gages—and skilled inspectors are scarce. But that need not interfere with precision in your plant.

Substitute for the gages that require skill, the gaging instruments which give you greater precision and at the same time eliminate the human factor. Sheffield precision gaging instruments in the hands of inexperienced inspectors are guarding product quality in hundreds of plants today.

Write for descriptive folder No. 43-1.

THE SHEFFIELD CORPORATION

DAYTON, OHIO, U. S. A.

SHEFFIELD GAGES
MASTER GAGEMAKERS

THEY'RE Rugged!

but make 'em last!

FORD CHAIN BLOCKS, whether **TRIBLOCS, SCREW HOISTS** or **DIFFERENTIAL HOISTS,** are rapidly, efficiently, and economically keeping their war loads moving. **FORD CHAIN BLOCKS** are sturdy mechanical soldiers in this war for freedom against tyranny—and as such deserve the consideration given all soldiers. They should not be overtaxed; they should not be weakened by overload; they should have a regular "ration" of lubricant. Here are five ways to make your **FORD CHAIN BLOCKS** last longer and do better work.

- The gear cover should be removed occasionally and a small quantity of heavy graphite grease applied to gear train.
- The load chain should be cleaned and lubricated frequently with a heavy oil, particularly at engaging points of links.
- Load sheaves should also be greased.
- Oil the bearings frequently so that no bearing will run dry and cause excessive wear.
- Oil holes are provided in the **TRIBLOC** at vital points. These should be used frequently.

When given intelligent care, thoroughly cleaned and lubricated at intervals, **FORD TRIBLOCS** will remain efficient under the hardest usage for a long time. Your **FORD HOIST** can be one of your best friends during this production emergency. Take care of it.

Order from Your Distributor

FORD CHAIN BLOCK DIVISION

Philadelphia, Chicago, Denver, Los Angeles, San Francisco, Portland

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

Production increased a FULL THIRD

With BARKER WRENCHLESS CHUCKS AND VISES!

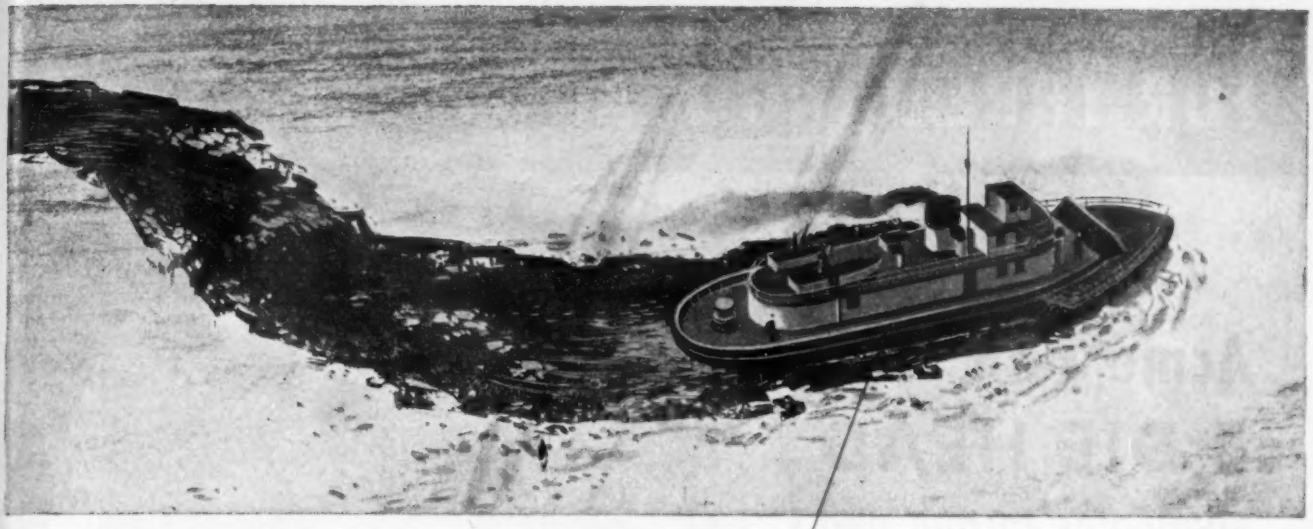
Made in two-jaw and three-jaw types, and as vises for use with milling machines, drill presses, and similar purposes.

Pieces-per-hour went up from 18 to 24 when the Lovejoy Flexible Coupling Company replaced an ordinary three-jaw chuck on this P & J Automatic Lathe with a Barker Wrenchless Chuck—and stayed up—because the Barker Chuck is a simple, rugged, self-contained unit, requiring no accessories, auxiliaries or outside source of power. From the moment of installation, it delivers speedy, trouble-free service. The Lovejoy plant has six Barker Wrenchless Chucks giving uniformly efficient service, turning coupling bodies.

There is nothing to service on a Barker Wrenchless Chuck—nothing to get out of order. From a trifling investment you obtain continuous generous dividends in time saved, production increased, upkeep practically eliminated.

Are you interested in similar results? Write today for full information. Ask for Bulletin 4-A.

THOMAS HOIST CO.
Chuck Division
20 South Hoyne Avenue, Chicago, Illinois



This **W·A·B** remote control installation

opens new channels of *product improvement* too . . .

How well W·A·B Remote Control equipment might serve on *your* product or production machinery is best demonstrated by the variety of complex jobs it is already doing.

Take this Ice Breaker, for instance. All the operations involved in maneuvering the engines . . . speed control, clutching or declutching, braking, and reversing . . . are governed by five or six inches of travel of two small handles, a hand's-breadth apart on the control stand. An easy, back-and-forth movement of another handle actuates the rudders. The dependability and responsiveness of the controls were picturesquely summed up by the operator, when he said, "I could write my name in the ice with this ship."

If you manufacture any mechanical device where a cycle or series of operations are controlled from some central point . . . or if in your plant there is need for some similar control . . . the chances are that W·A·B Remote Control Systems will do the job better, easier, and at less cost. In many instances standard, "off the shelf" W·A·B devices, immediately available, are all that are required. If you will outline your control problem, one of our representatives will be glad to make recommendations. Write, wire or phone.

Westinghouse Air Brake Company

INDUSTRIAL DIVISION

General Offices: Wilmerding, Pa.

74 Years of Pneumatic Control Experience

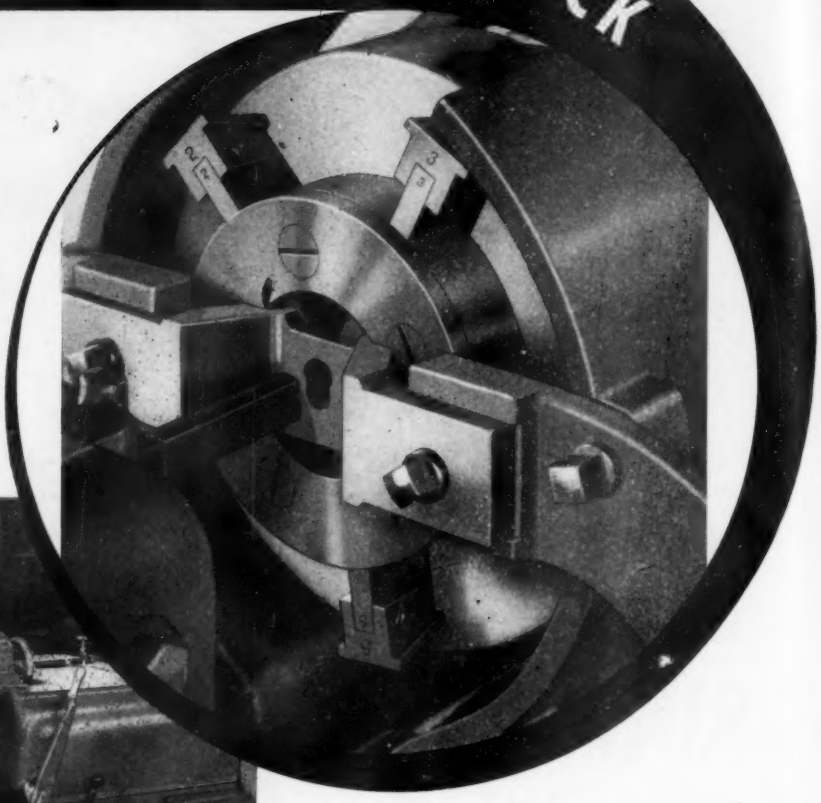
W·A·B

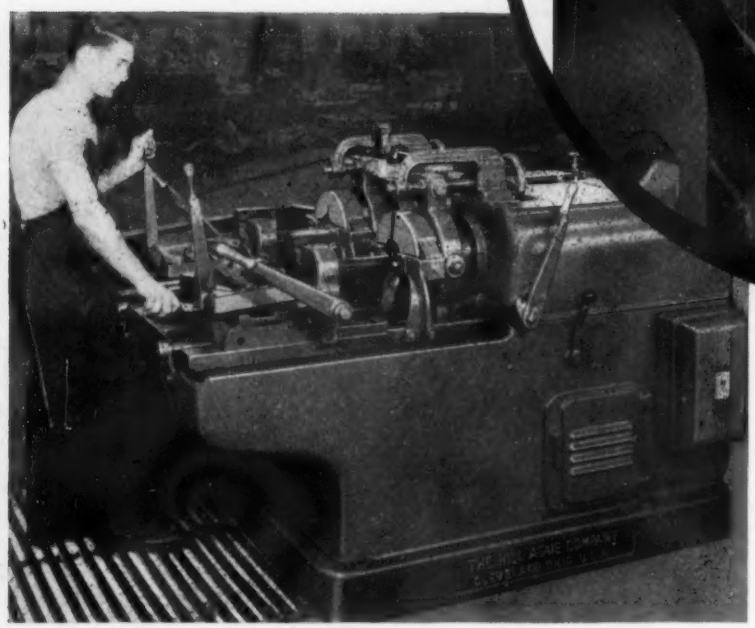
PNEUMATIC
PNEUMATIC-ELECTRIC
PNEUMATIC-HYDRAULIC

remote control systems

FOR THREADING FLAT BAR STOCK

The Acme Hob Type 5 DIE HEAD eliminates torque and speeds production





Threading pipe wrench jaws at the Ridge Tool Co. with a 2" double spindle ACME Threading Machine and an ACME hob type 5 die head.

The problem of threading flat bar stock with an interrupted cut, is solved by the ACME hob type 5 die head. This special head insures three chasers always being in contact with the work. In the five die head shown above, a guide bar has been attached to compensate for the torque developed when threading long bar stock. This adaptation of ACME Threading Equipment to difficult jobs, illustrates why the large percentage of pipe wrench manufacturers are using ACME Threading Machines today. Bulletin 843 gives complete details.

ACME MACHINERY DIVISION

of THE HILL ACME COMPANY

Established 1882

FORGING · THREADING · TAPPING · BOLT · NUT · RIVET MACHINES

4535 ST. CLAIR AVENUE
CLEVELAND, OHIO

Toolroom heat treating in a *package*

. . . a preheat furnace, a high speed furnace and a tempering furnace, plus complete quenching equipment can be supplied in its entirety by Lindberg for the precision heat treatment of your finest tools and dies.

1. The preheat and high speed hardening furnaces employ the Lindberg Hydryzing process for hardening *all* tool steels. Hydryzing is economical because it saves you the expense of costly cleaning operations such as sandblasting, polishing, stoning, etc. Its neutral atmosphere protects all tool steels from scale, decarb and carburization with the consequent assurance of long productive tool life.

2. The famous Lindberg principle of tempering solely with recirculated air, plus the precision and uniformity of heating are a few of the reasons why the Lindberg Cyclone Tempering Furnace is the most widely used tempering unit in the field today. The result of the Cyclone's close heating control and uniformity is perfect tempering to specifications with the desired toughness for maximum tool life.

3. With full toolroom setups, Lindberg can supply pot furnaces and complete equipment to meet any quenching requirements.

Learn how you can have all the advantages of clean, full hardening and accurate, low-cost tempering. Write TODAY for Bulletins 94 and 62.

A typical tool for Hydryzing is this bell shaped cutter, which is made of Moly High Speed Steel. It is 2 17/32" long through the bore, has a 5" outside diameter and weighs 8¼ lbs.

It was preheated in a Hydryzing Furnace at 1500°F., for 48 minutes, then placed in the high speed furnace for 12 minutes at 2225°F. It was quenched from 2225°F., into an 800°F., lead bath to avoid cracking at the sharp recesses of the teeth. From the lead bath it was allowed to cool to 150°—180°F.

In a Cyclone Toolroom Tempering Furnace, the cutter was heated for 2 hours at 1025°F., removed and allowed to cool to room temperature. Hardness was 65-67 Rockwell "C".

LINDBERG FURNACES

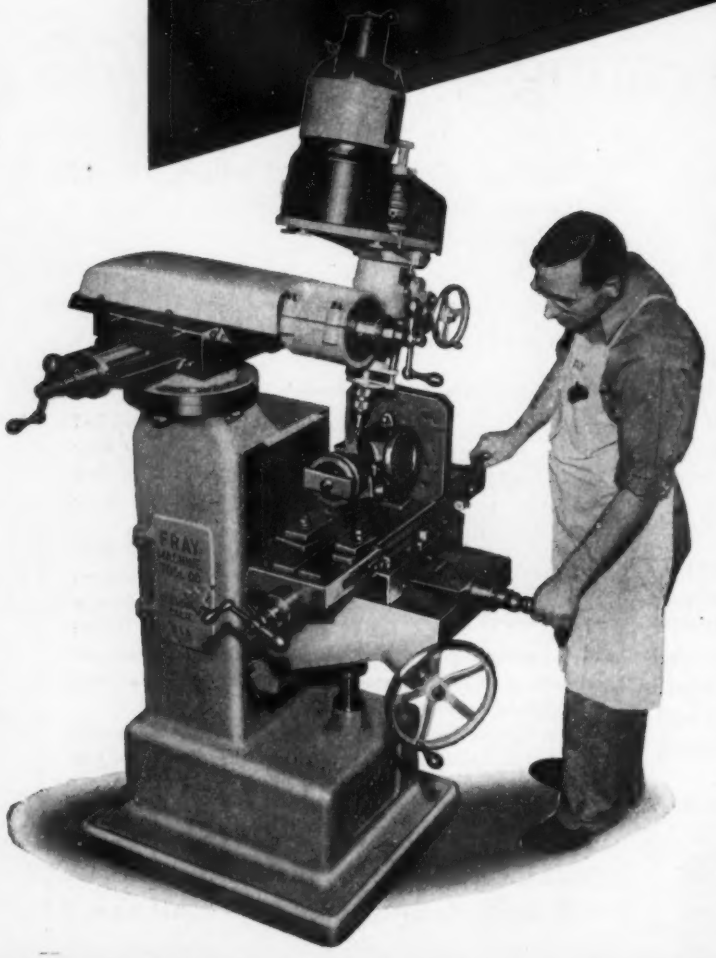
LINDBERG ENGINEERING COMPANY
2445 West Hubbard Street • Chicago, 12

ARMY E NAVY

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

ONLY ONE WORK SET-UP for *all* operations with

Fray RAM TYPE No. 7-B UNIVERSAL MILLING MACHINES



The 10" cross movement of the ram above the work, as well as the 12" transverse movement of the ram, combined with the 360 deg. rotation of the turret head—give a range of operations with one work set-up that is *not possible* with any other milling machine.

In addition to the controlled movement of the ram and turret, the "All-Angle" milling head can be rotated 360 deg. in horizontal or vertical planes, so that the head can be instantly set to any angle or compound angle.

For positive and accurate travel, ball cranks mounted on feed screws carry 3" dials and are calibrated in one-thousandths. The table working surface measures 7½" x 29", and has a cross feed travel of 7". Table stops calibrated in one-thousandths.

These are precision tools in every sense of the word — designed by toolmakers for use by toolmakers.

Write for descriptive literature.

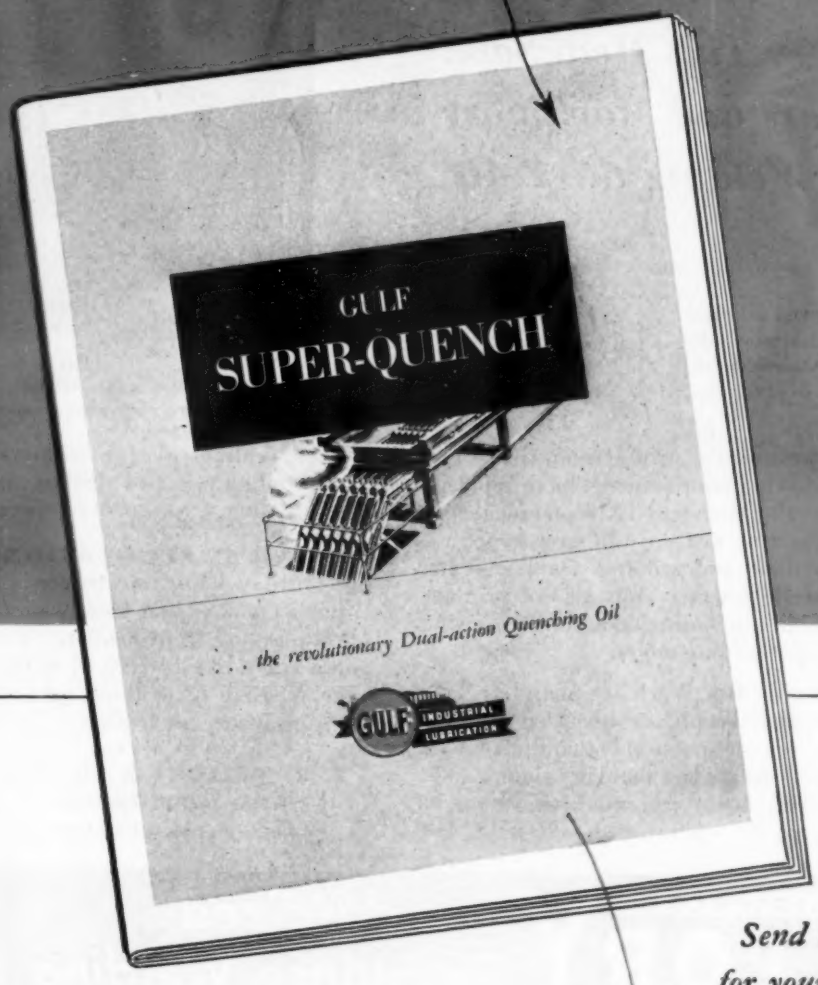
FRAY MACHINE TOOL CO.

517 WEST WINDSOR ROAD • GLENDALE 4, CALIFORNIA

Manufacturers of Fray Micrometer Offset Boring Heads, and Fray "All-Angle" Milling Attachments

Announcing:

A brochure on Gulf Super-Quench



Send this Coupon for your copy

Just off the press, this new brochure contains 16 pages of information on the properties and advantages of Gulf Super-Quench, the revolutionary new dual-action quenching oil developed by Gulf, which has produced such outstanding results in the heat treatment of many types of steel used in the manufacture of war materiel. Send the coupon below for your copy of this interesting publication.

GULF OIL CORPORATION · GULF REFINING COMPANY

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company AM
3800 Gulf Building, Pittsburgh, Pa.
Please send me, without obligation, a copy of the new brochure, "Gulf Super-Quench."

Name .....

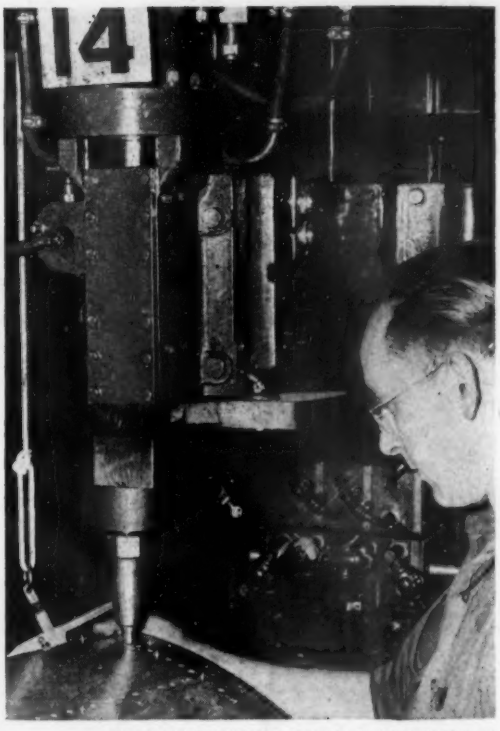
Title .....

Company .....

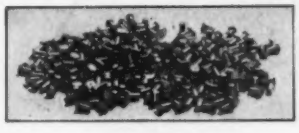
Address .....

The Emphasis is on Saving

Mallory Tips Help Save Man Hours and Machinery in Spot Welding the P-40



PHOTOGRAPHS COURTESY CURTISS-WRIGHT CORPORATION



Spot welding saved all these rivets which would normally be required to assemble the Curtiss P-40 belly cowl.

Thanks to phenomenal advances in machines and techniques, aircraft manufacturers have replaced slow, costly riveting with speedy, economical spot welding. This is true not only of non-structural parts such as door and window frames, seats, engine and nacelle cowling—but also of primary stressed assemblies including floor supports, wing ribs and stabilizer leading edges.

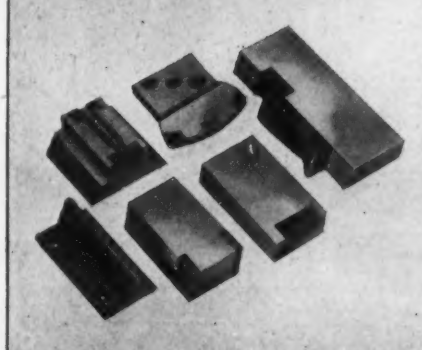
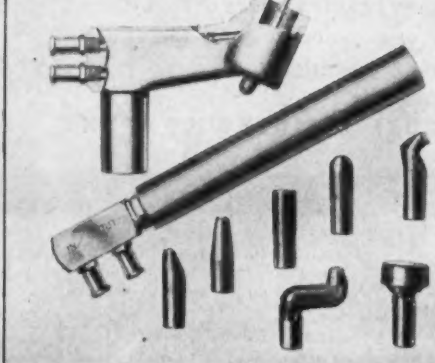
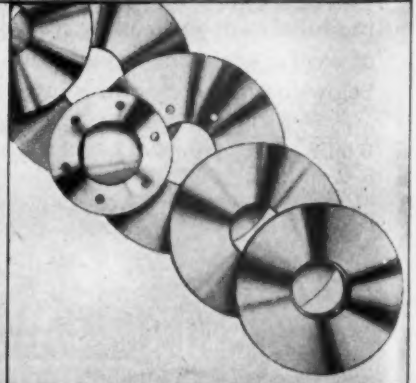
Assembling the Curtiss Warhawk belly cowl, as shown in the photograph, is done on a magnetic impulse type of spot welder equipped with Mallory long-life electrodes. On many similar jobs, a template is laid down and markings made of pilot spots where the operator should weld. Use of spot welding saves man hours and machinery by the elimination of drilling and dimpling for flush riveting, two separate operations.

TECHNICAL SUGGESTIONS on specifying resistance welding electrodes . . . for fabricating either ferrous or non-ferrous metals . . . are yours for the asking from Mallory. Write us today . . . and if you'd like a free copy of the Mallory Resistance Welding Data Book for your guidance, just mention it in your letter.

P. R. MALLORY & CO., Inc.
INDIANAPOLIS, INDIANA
Cable Address — PELMALLO

P. R. MALLORY & CO. Inc.

MALLORY *Standardized Resistance Welding Electrodes*

FLASH, BUTT, PROJECTION WELDING DIES	SPOT WELDING TIPS AND HOLDERS	SEAM WELDING ROLLS
		

SPEEDIER PRODUCTION · LESS DOWN TIME · BETTER WELDING · LOWER COST

WHEN YOU WANT TO KNOW ABOUT STAINLESS...

Every man who works with Stainless Steel needs a copy of the *Handbook* compiled by the Rustless Iron and Steel Corporation.

It is the *end-product* of the vast experience of the only company in the United States, all of whose facilities are devoted exclusively to making Stainless Steel.

In pictures, charts, graphs and photo-micrographs . . . in clear, explicit words . . . it tells what Stainless Steel will, and will not accomplish. It is your guidebook on *when, where, how* and *why* to use the various types of Stainless. A copy will be sent to you on request.

Rustless Service does not stop with placing this book in your hands. Every order we receive from you is checked and rechecked by men who (like all Rustless personnel) are specialists on the applications of Stainless Steel. They will help you to avoid ordering the wrong type of Stainless Steel.

IF IT'S URGENT,
ASK RUSTLESS BY PHONE.
CALL WOLFE 5400, BALTIMORE, MD.

RUSTLESS
CORROSION AND HEAT-RESISTING
STAINLESS STEELS

Producing STAINLESS STEEL *Exclusively*

RUSTLESS IRON AND STEEL CORPORATION, BALTIMORE, MARYLAND

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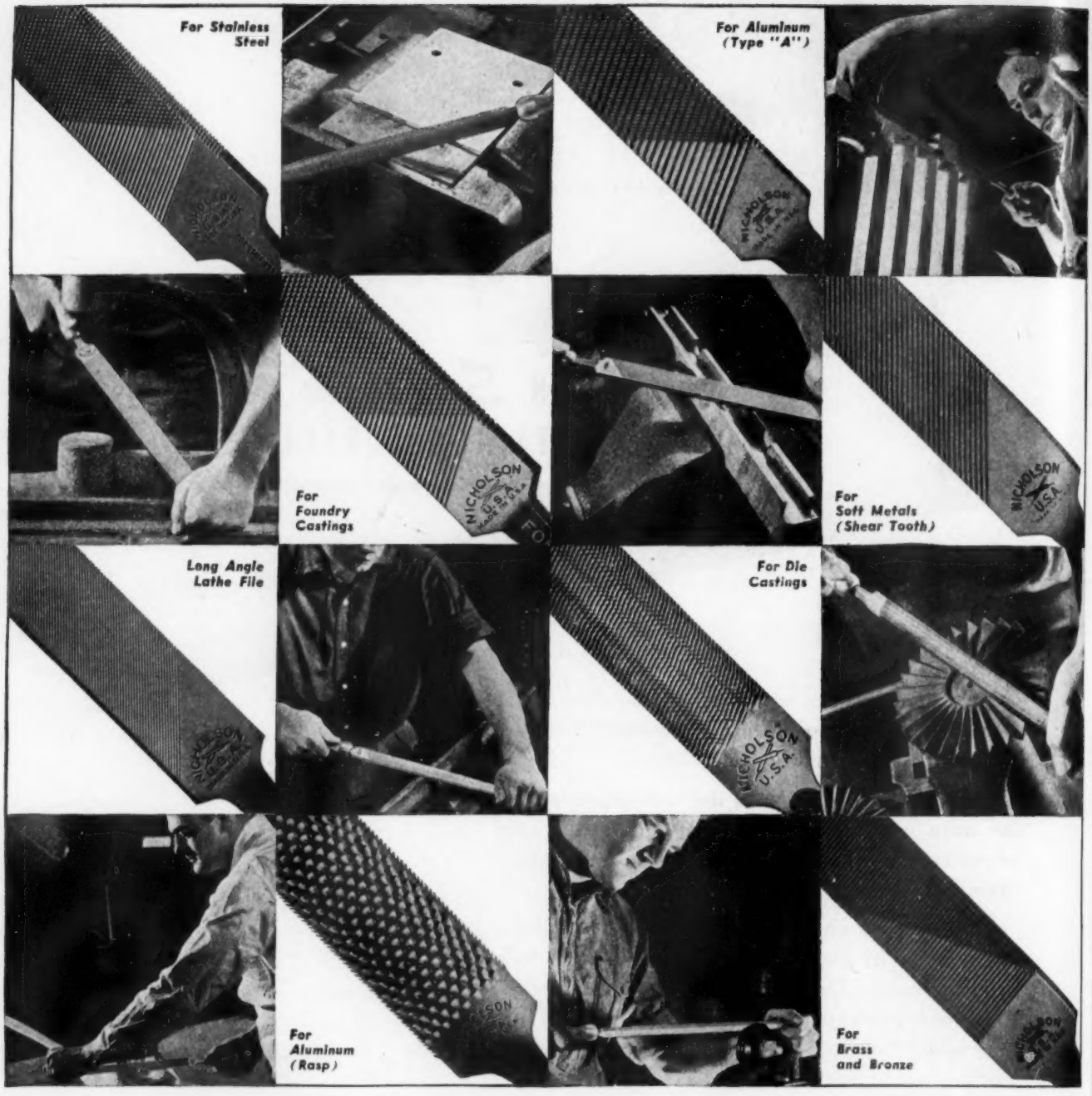


The right file speeds the job, cuts the cost

Nothing has ever so sharply emphasized the value of special tools for specific jobs as the mass production programs of our huge war industries.

They justify, conspicuously, this company's far-sighted pioneering in designing many of the special purpose files which today are speeding up thousands upon thousands of individual filing operations.

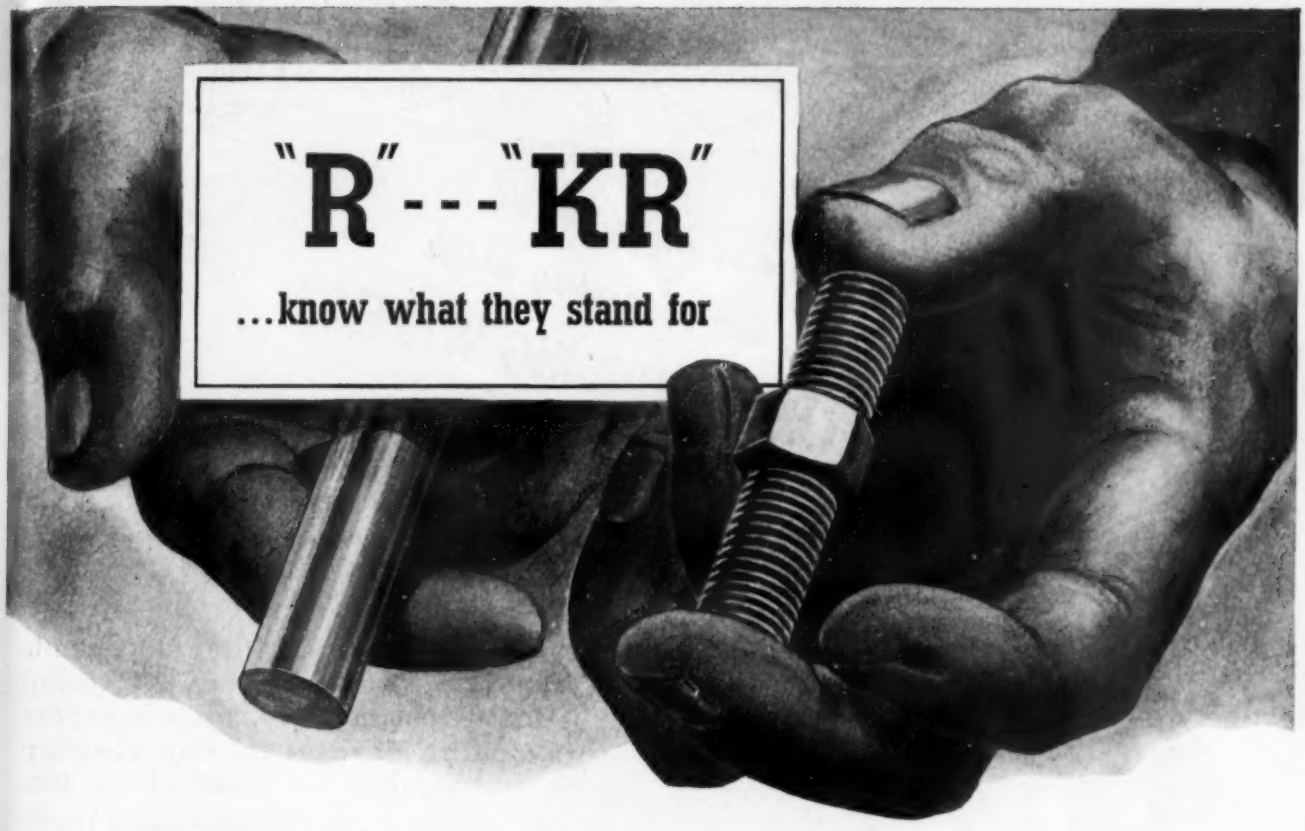
Besides supplying large quantities of the Nicholson or Black Diamond Special Purpose Files shown above, Nicholson has recently developed a special file for tank armorplate fitting; and another for magnesium filing in incendiary bomb manufacture. . . . Nicholson research never rests—and quality manufacture is never lowered. *Send us your filing problems.*

FREE BOOK. Send for *"File Filosophy,"* the 48-page Nicholson book. Tells more about the above-illustrated and other files; about proper use and care of files, etc.

Nicholson File Co., 29 Acorn St., Providence 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.



Special Monels with Superior Machining Properties

The strength and corrosion resistance of Monel are so well known that they require no comment.

But do you realize that in addition to *regular* Monel, there are two *special* Monels—"R" Monel and "KR" Monel?

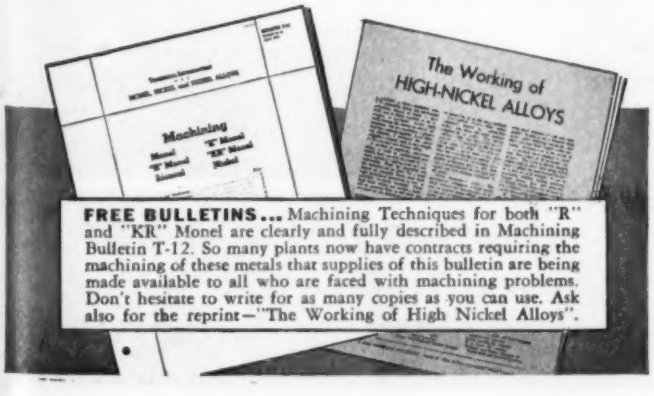
"R" Monel . . . When introduced several years ago, "R" Monel made available the properties of Monel coupled with improved machinability.

"R" Monel is readily fabricated by cold forming—is produced as hot-rolled and cold-drawn rounds, squares and hexagons. It is ideally suited for the automatic production of rust-proof screw machine parts, yet has mechanical properties equal to steel screw stock (S.A.E. 1112), and is actually tougher. "R" Monel is NOT heat-treatable. (See "KR" Monel below.)

"KR" Monel . . . The newest member of the Monel family, "KR" Monel, offers machining qualities you wouldn't expect to find in a metal with so many other superior properties—corrosion resistance combined with non-magnetic characteristics, plus exceptional hardness and strength that can result only from heat treatment.

"KR" should be used for screw machine products which are to be heat treated after machining. Remember "KR" Monel as the MACHINABLE brother of "K" Monel, long known for its great strength and hardness. The International Nickel Company, Inc., 67 Wall Street, New York, N. Y.

★ ***SAVE MACHINING TIME AND MONEY . . . Specify "R" Monel and "KR" Monel***



FREE BULLETINS . . . Machining Techniques for both "R" and "KR" Monel are clearly and fully described in Machining Bulletin T-12. So many plants now have contracts requiring the machining of these metals that supplies of this bulletin are being made available to all who are faced with machining problems. Don't hesitate to write for as many copies as you can use. Ask also for the reprint—"The Working of High Nickel Alloys".

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N. Y.

Gentlemen: Please send me copy of your Machining Bulletin T-12 and also the reprint "The Working of High Nickel Alloys."

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COMPANY _____ TITLE _____

ADDRESS _____

8-5-43

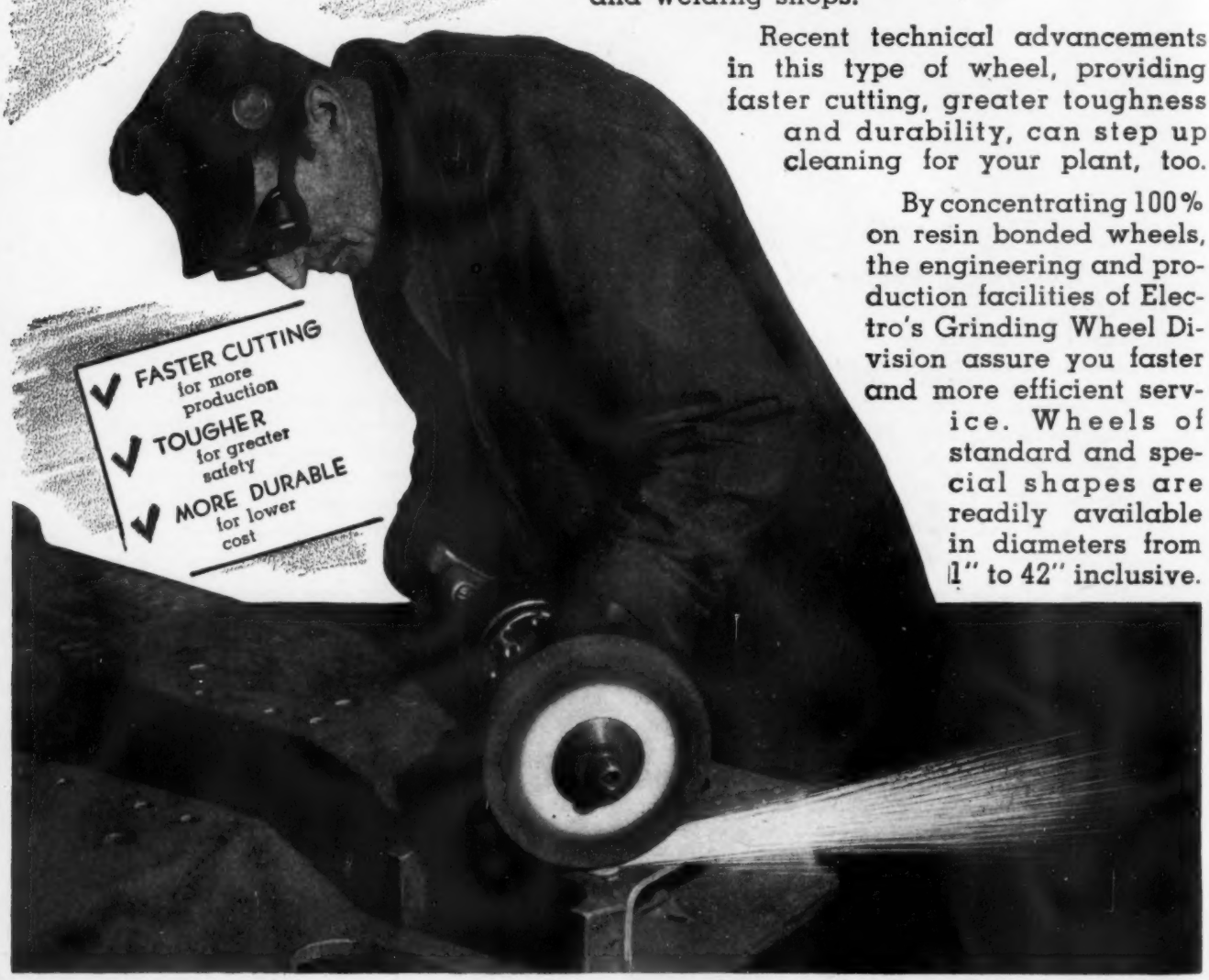
"You bet we'll step on it - by speeding up cleaning with

ELECTRO PORTABLE GRINDING WHEELS"

The high metal removal rate of Electro Resin Bonded Portable Wheels is speeding up war work for many ferrous and non-ferrous foundries, steel mills and welding shops.

Recent technical advancements in this type of wheel, providing faster cutting, greater toughness and durability, can step up cleaning for your plant, too.

By concentrating 100% on resin bonded wheels, the engineering and production facilities of Electro's Grinding Wheel Division assure you faster and more efficient service. Wheels of standard and special shapes are readily available in diameters from 1" to 42" inclusive.



ELECTRO REFRACTORIES AND ALLOYS CORP.

GENERAL OFFICES: ANDREWS BUILDING, BUFFALO, N. Y.

Manufacturers of Crucibles Alloys, Stoppers, Refractories, Grinding Wheels

★ Just a little more than one year ago we were awarded the Navy "E" Burgee as a result of the tireless effort of "AUTOMATIC" employees in the continued production of equipment essential to the war effort.

Our organization, loyal to the core, has kept up the pace set when Uncle Sam first called for all out production.

So now, for the third time "AUTOMATIC" employees have won the Navy Production Award for meritorious service on the industrial field of battle.

The SECOND SILVER STAR has been placed on the Navy "E" Burgee we so proudly fly.

We'll keep it up—that is the spirit that prevails at "AUTOMATIC." Here we are all dedicated to the task of producing more and producing on time.

MANUFACTURERS FOR OVER 35 YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.

DIV. OF THE YALE & TOWNE MFG. CO.

59 WEST 87th STREET CHICAGO, ILLINOIS

CLEANER GRINDING COOLANTS *in the Shop* INSURE BETTER PERFORMANCE *at the Front!*

PRECISION grinding calls for clean grinding coolant. Possibly, too, it calls for a more efficient—and more expensive—type of coolant. De Laval Coolant Clarifiers meet both these needs—by keeping coolant clean at all times and by enabling the same coolant to be kept in service for an indefinite period. Continuous removal of impurities from coolant with a De Laval Clarifier, of course, avoids scratches on the work or damage to sub-surface structure and makes it possible to grind within closer limits.

In most grinding operations numerous other economies are effected by the De Laval Coolant Clarification System. Softer wheels can be used; the life of wheels is increased; production is speeded up, and there are fewer rejections.

Write for full information regarding these and other economies effected by De Laval centrifugal machines in modern metal working plants.

DE LAVAL "Hermetic" COOLANT CLARIFIER

THE DE LAVAL SEPARATOR COMPANY

165 Broadway, New York 427 Randolph St., Chicago

DE LAVAL PACIFIC CO., 61 Beale St., San Francisco

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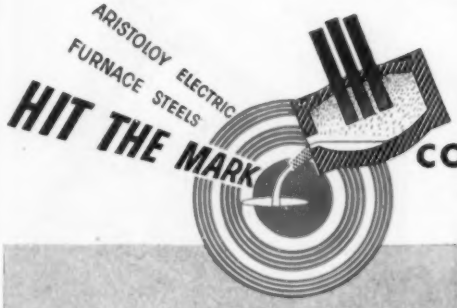
The TOP QUALITY steels are ELECTRIC FURNACE STEELS

The chemical analysis and specifications of top quality steels, such as stainless, aircraft quality, special alloy, etc., must be precision controlled. The electric furnace is the most efficient method by which the steel maker can hit these close specification marks consistently and accurately.

Aristoloy Steels are made only in electric furnaces. Today, they are fighting and flying in battle. Tomorrow, they not only will fly, but will perform everyday miracles for all of us in the form of new, peacetime products.



COPPERWELD STEEL COMPANY · WARREN, OHIO

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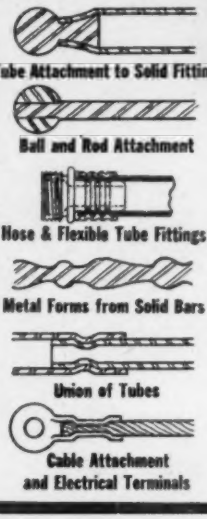
CARBON AND ALLOY TOOL STEELS
STAINLESS STEELS · NITRALLOY STEELS

ELECTRIC FURNACE STEELS

TYPICAL APPLICATIONS



Tube Attachment to Solid Fitting

Ball and Rod Attachment

Hose & Flexible Tube Fittings

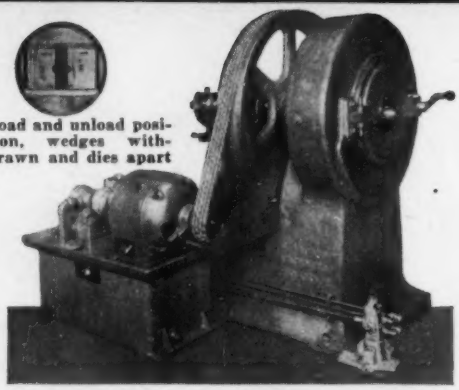
Metal Forms from Solid Bars

Union of Tubes

Cable Attachment and Electrical Terminals

New "STANDARD" HYDRO-FORMER

SHAPES AND JOINS METALS . . . WITHOUT CUTTING



Load and unload position, wedges withdrawn and dies apart

Saves TIME, LABOR, METAL

In one operation, this machine connects tubing or cables to solid fittings, or forms metal sections from solid bars without cutting. A feature of its design is the use of hydraulically-operated wedges to compress the dies so that swaging force is applied at right angles to the work . . . not obliquely as with tapered dies. In reducing outside diameter of tubing, therefore, tendency toward elongation is lessened and thickness of tubing wall is increased. Fittings having large ends can be put into machine without removing dies. This machine simplifies handling of many other operations which previously required more complex, time-consuming methods.

Further information on request

STANDARD MACHINERY CO.
PROVIDENCE RHODE ISLAND

How Can AMERICAN MACHINIST ADVERTISING Help You More?

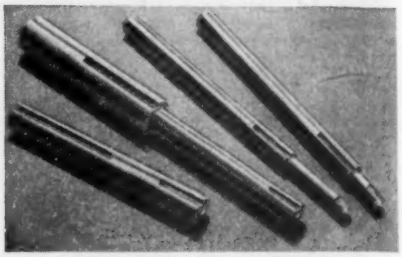
Advertisers in this publication are constantly trying to give you practical data to help speed your war production. Tell us what you want to know *now* . . . We will transmit your requests. No obligation . . . no sales follow-up . . . merely a service to make advertising more helpful.

★ *Write Reader Service Department of*

AMERICAN MACHINIST
330 West 42nd Street, New York

PRECISION PARTS

4 MORE ACES UP UNCLE SAM'S SLEEVE



Precision-machined, precision-ground on all diameters and threads.

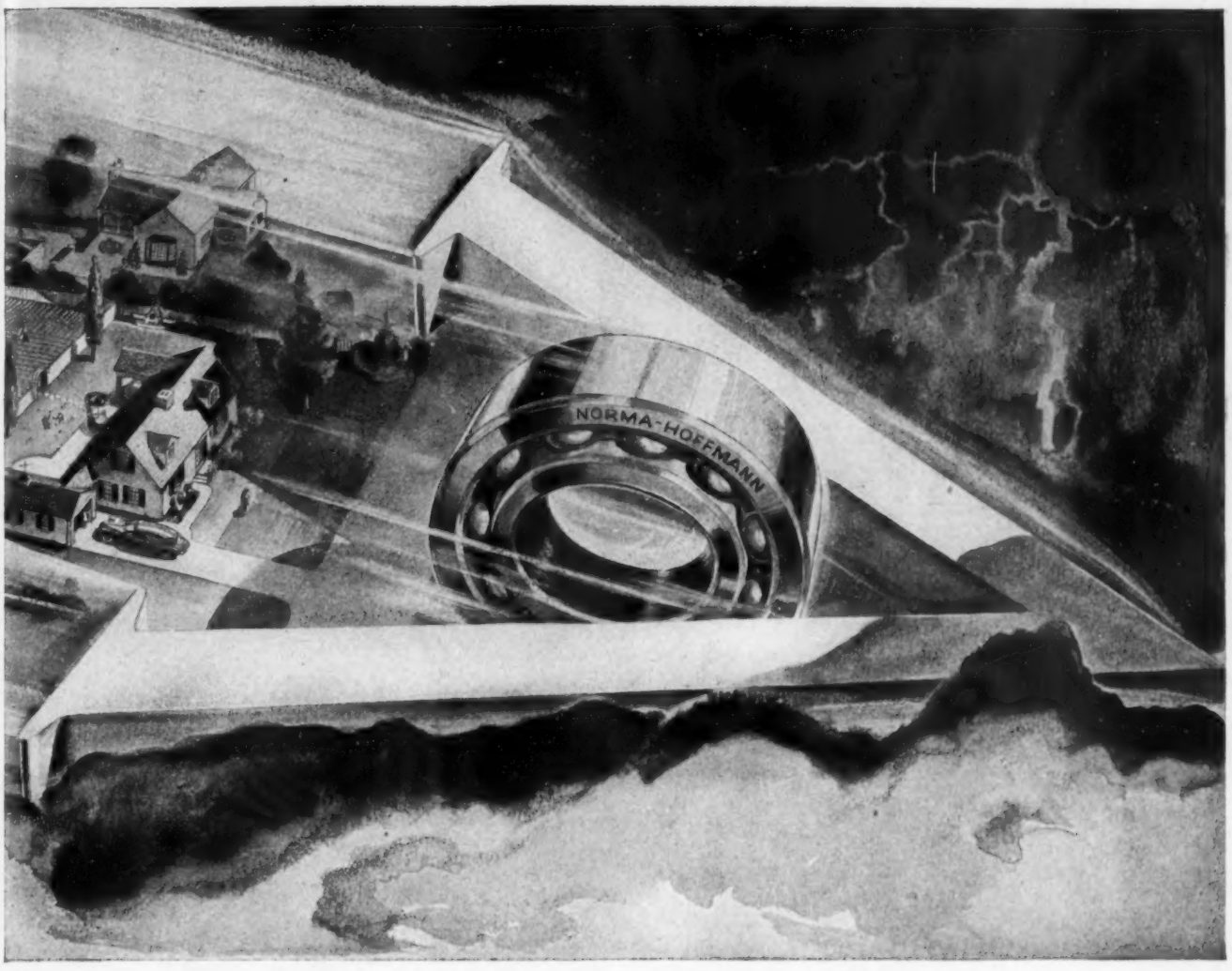
Elevating shafts . . . vertical training shafts . . . screw leveling shafts . . . just so many metal parts to the uninitiated. To the Jap pilot in a Zero, however, they mean anti-aircraft fire too accurate for comfort.

These vital parts of an anti-aircraft gun are typical of the ability of Ace to do fine precision-work on a mass-production basis. The ground tolerances are .0003" (1/30 the thickness of a human hair) . . . key-ways are held within .0004" and must be absolutely parallel from end to end and side to side . . . concentricity between diameters is held to less than .0005" . . . and threads must be ground for the fine accuracy so essential to final assembly and quick replacement.

Today, the demand is for speed, and Ace offers its facilities to other manufacturers on a 24-hour-a-day, 7-day-a-week production basis, embracing: 1. The finest machines in the industry. 2. Managerial know-how for producing parts twice as fine, ten times as fast, as ever before. If you have small parts for stamping, machining, grinding, or assembling, send us a sample, a sketch, or a blue-print for quotation.

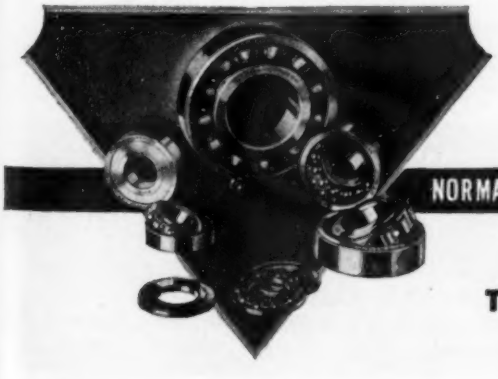
This new booklet describes the facilities available at Ace for the machining, assembling and heat treating of small parts. A copy will be gladly sent upon request.

ACE
ACE MANUFACTURING CORPORATION
for Precision Parts
1207 E. ERIE AVE., PHILADELPHIA 24, PA.



TODAY—"on land, at sea and in the air", on fighting fronts and production lines—NORMA-HOFFMANN PRECISION BEARINGS are contributing to the Victory that will clear away the clouds of war.

TOMORROW—bettered by the added skill and experience gained in war-time — they will be equally instrumental in solving the problems of design and production of a world at peace.

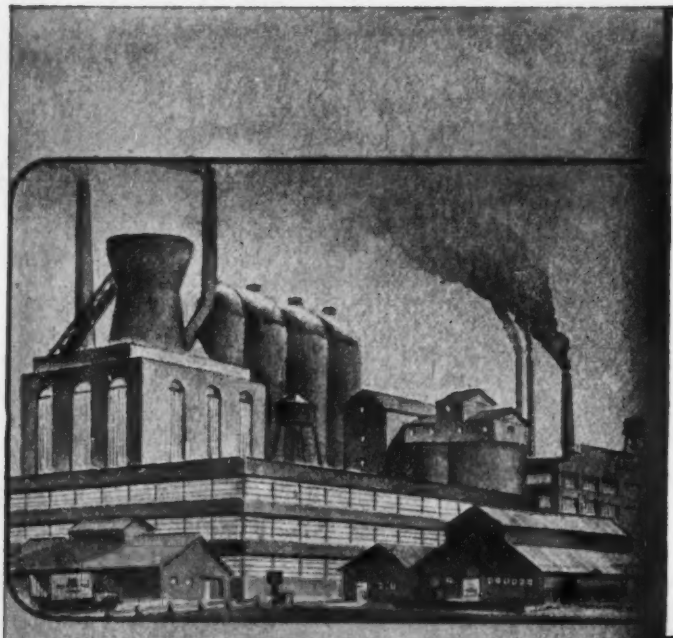


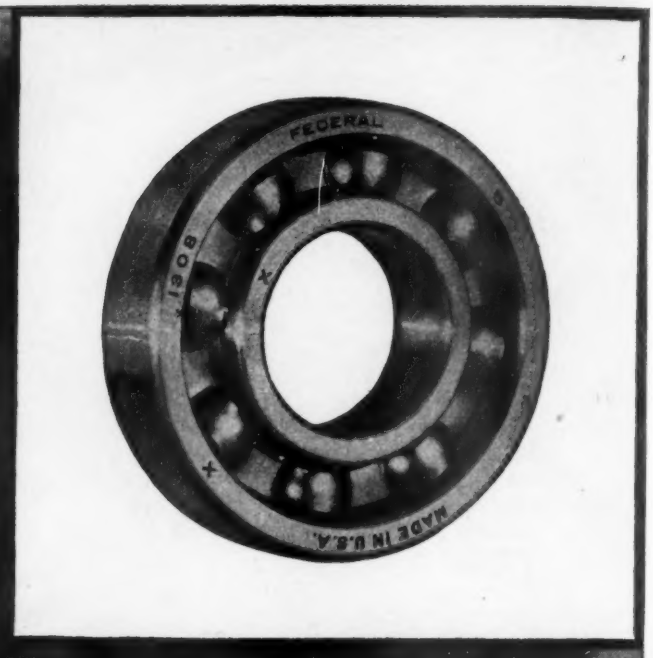
Let our engineers work with you, NOW.

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN., U.S.A. FOUNDED 1911

PRECISION BALL, ROLLER AND THRUST BEARINGS

TO WIN THE WAR—*Work—Fight—Buy War Bonds!*





FEDERAL BEARINGS are now serving the armed forces of the United States in the air and on land and sea. These **QUALITY** bearings are used, also, for all industrial purposes.

FEDERAL BEARINGS

As the facilities and resources of the FEDERAL organization are devoted almost entirely to the war effort we are unable to supply many types of bearings formerly manufactured.

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THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

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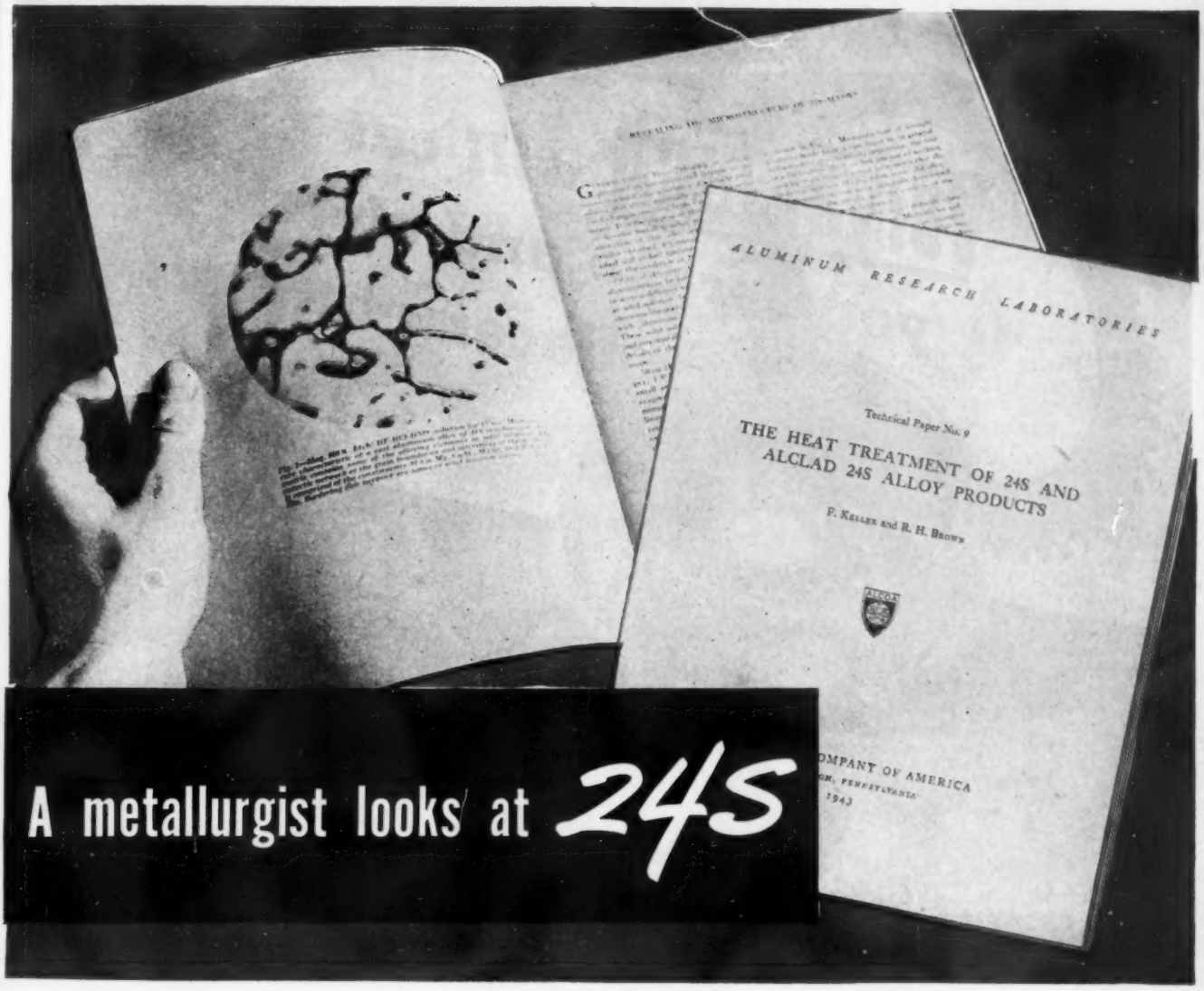

ALUMINUM RESEARCH LABORATORIES
Technical Paper No. 9
THE HEAT TREATMENT OF 24S AND ALCLAD 24S ALLOY PRODUCTS
F. Keller and R. H. Brown
1943

A metallurgist looks at 24S

Aluminum alloy 24S is used in aircraft construction for parts subjected to high stress; 24S and Alclad 24S sheet and strip for airplane skin and structural members, 24S wire for rivets. Parts made of this alloy are hardened and strengthened by heat treatment.

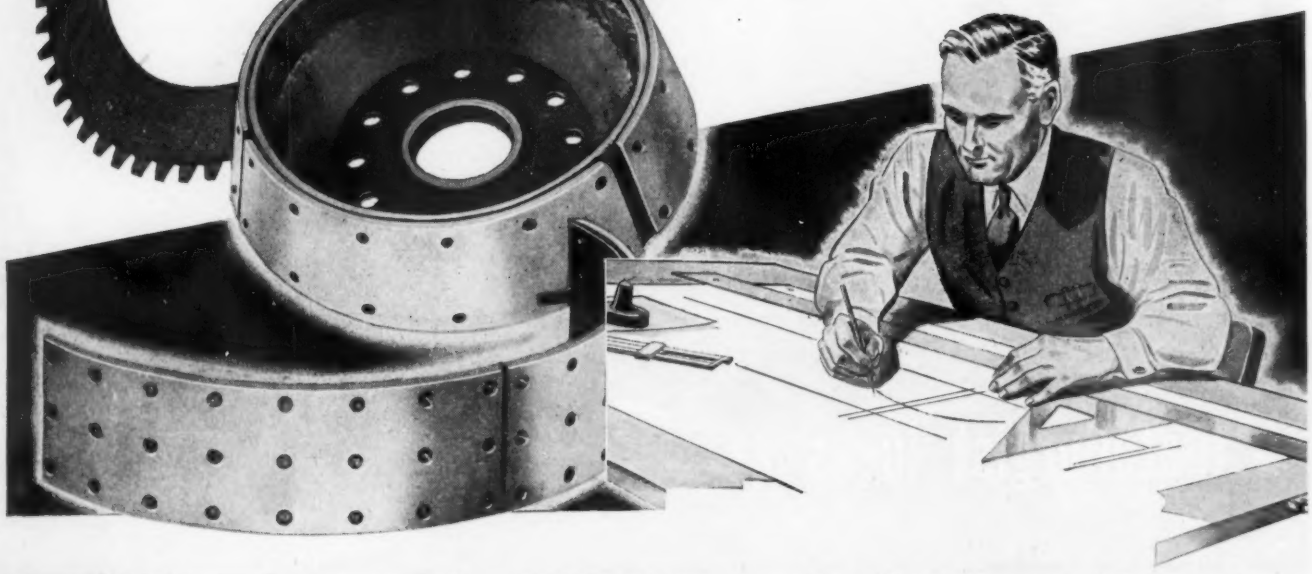
Technical Papers No. 8 and No. 9, pictured above, tell how you can check the effectiveness of heat treatment. Metallographic methods of examination and the results obtained are outlined. You can detect variations from standard practices by comparing samples taken from your production with those pictured in these papers.

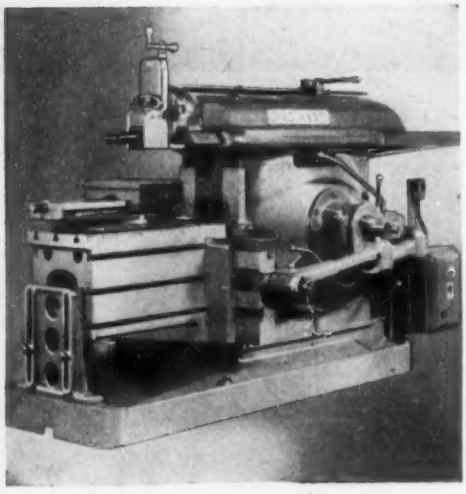
Practices described have been used at Aluminum Research Laboratories and in the industry for many years. When these methods are followed closely, and the proper skill attained, it is possible to determine many pertinent facts about 24S from metallographic examinations. Your metallurgist should have these two booklets.

For copies of Technical Papers No. 8 and No. 9, write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Bldg., Pittsburgh, Pa.

ALCOA ALUMINUM

Velvetouch will cut your brake and clutch replacement cost!

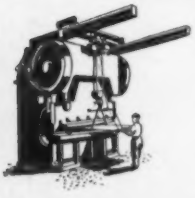


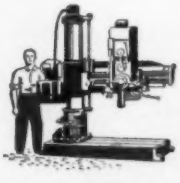


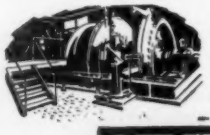
VELVETOUCH is an all-metal friction material—a combination of sintered powdered metals, welded to a solid steel backing. It is engineered to wear many times longer than ordinary clutch facings and brake linings . . . requires fewer adjustments and replacements.

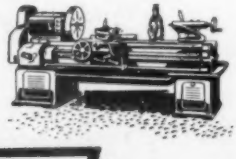
In operation, Velvetouch is smooth and positive. It is not affected by oil, heat or water. Clutches and brakes equipped with Velvetouch never chatter, never slip.

Specify Velvetouch for your shapers. Install it on your radial drills, presses, lathes, forging machines, industrial trucks, cranes and other machine shop equipment . . . . wherever you have a clutch or brake maintenance problem!









TRADE MARK REG U S PAT OFF.

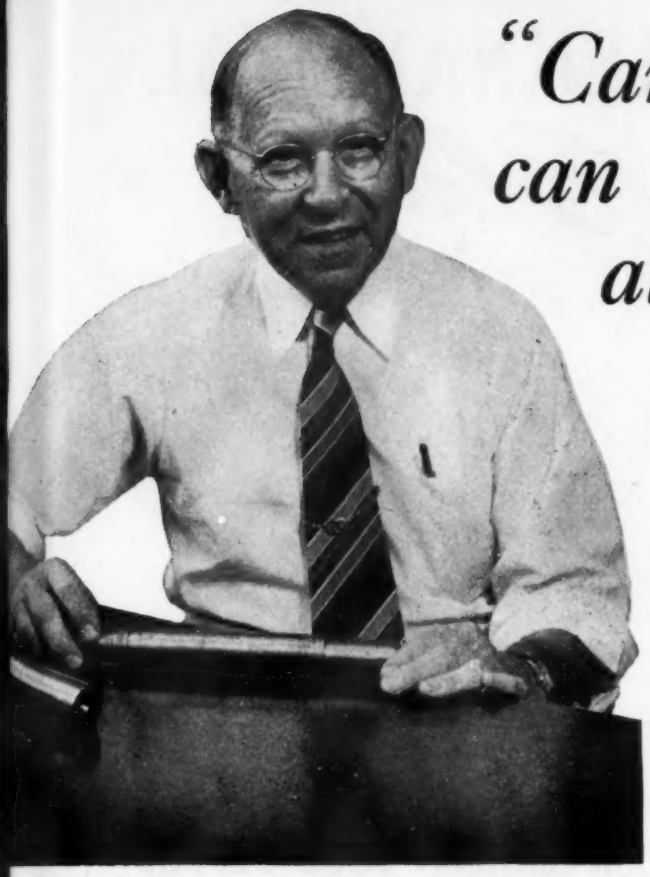
Velvetouch

THE S. K. WELLMAN CO.

1374 EAST 51ST STREET
CLEVELAND, OHIO, U.S.A.

PIONEERS IN PUTTING POWDER METALLURGY TO WORK FOR INDUSTRY

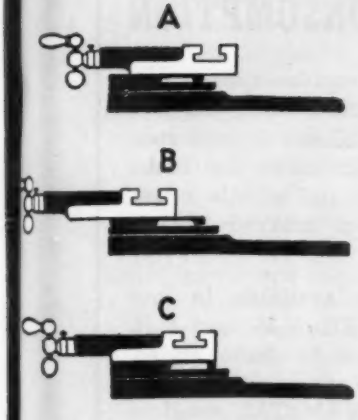
CUTTING TOOL TIPS FROM THE TOP-NOTCHERS—#6



"Care in rough cutting can save valuable time all along the line."

Says FRANK C. LANG, Superintendent
THE R. K. LeBLOND MACHINE TOOL CO.
Cincinnati, Ohio

• Many new lathe hands, even some old-timers, consider rough turning a kind of hacking process that doesn't call for much brain work or care. While roughing isn't directly as important as finishing, there are many places where an operator can avoid needless waste of material . . . save himself and others valuable minutes by remembering a few simple do's and don'ts.



"In rough cutting care should be taken to have the compound rest in the proper position. In both positions, Fig. 'A' and Fig. 'B,' a break could result in the middle of the tee slot. Fig. 'C' is correct. When making heavy cuts, top slide should be flush with bottom slide so all metal is in compression.

CHART FOR CEMENTED CARBIDE TOOLS

KIND OF MATERIAL	CUTTING SPEED Ft. per Min.	DEPTH OF CUT Inch.	RATE OF FEED Per Rev.
CAST IRON	210	3/8	0.062
SEMI-STEEL	280	1/8	0.012
TOOL STEEL	140	1/2	0.020
BRONZE	425	3/16	0.024
BRASS	458	3/32	0.108
ALUMINUM ALLOY	570	1/8	0.031

"There is a tendency for many lathe operators to work their machine far below top efficiency because they fail to take a deep enough bite. Where tool failure is the limiting factor in size of roughing cut, it is usually possible to reduce the speed but increase the feed to such an extent that the amount of metal removed is greater than when operating at a faster clip. When using carbide type tools, the figures shown in above chart can be used for a general guide.

"In rough turning, hard-to-replace tools are often neglected because the operator thinks he can get by with a tool so dull that it actually is pushing the metal off instead of cutting it off. The best method for grinding tools is by the semi-automatic grinding machine. To cut free, a tool must be ground with four correct angles—side clearance, back rake, side rake, and end clearance. Refer to a tool manufacturer's manual."

Care in the selection of your cutting oil is as important as care in lathe operation. That's why Shell has developed a control technique that "balances" the oil to the machine, the application and the tool. Call in the Shell man now for details.

SHELL

SHELL LATA OILS
FOR METAL WORKING

SECOMET

DIAMOND WHEELS

can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, brouches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.

J. K. SMIT & SONS

157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

KENNAMETAL

Blanks

FOR FAST CONVENIENT TOOL SUPPLY FOR THE REDUCTION OF SHANK STEEL CONSUMPTION

KENNAMETAL steel-cutting carbide tools can be made in your shop by torch brazing KENNAMETAL standard or formed blanks to used steel shanks. This technique eliminates the maintenance of large tool stocks and affords a fast, economical, and convenient method of tool supply.

KENNAMETAL blanks are available in four grades of hardness, KM, KH, K_3H, and K_4H. The standards are supplied in three styles; formed blanks are shaped to specifications. The "stocking up" of KENNAMETAL standard and formed blanks will insure your shop of an adequate tool supply without excessive capital investment.

Write today for the KENNAMETAL Catalog 43B — it contains information on blanks and the proper method of brazing them to shanks.

KENNAMETAL THE All America CARBIDE

KENNAMETAL Inc.

103 LLOYD AVENUE, LATROBE

Trade Mark Reg. U. S. Pat. Off.

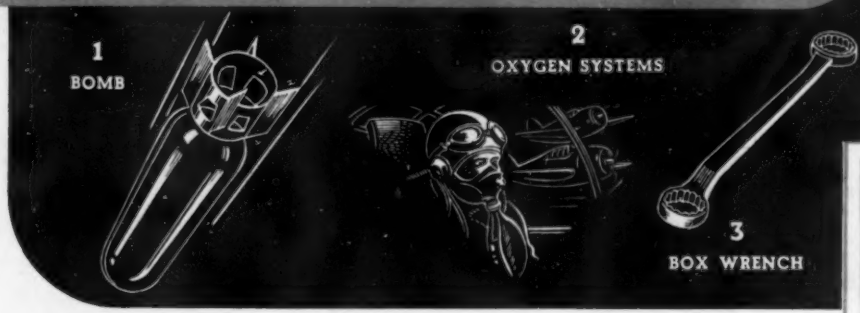
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

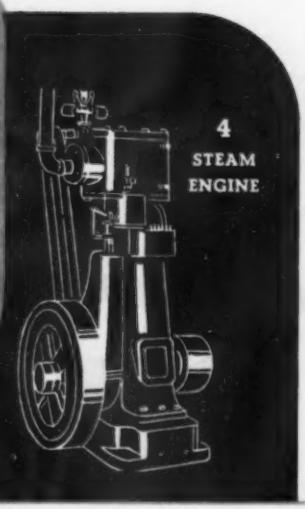
WIN A WAR BOND . . . tell why

dag COLLOIDAL GRAPHITE

REG. U.S. PAT. OFF.

IS IMPORTANT in the Manufacture or Use of Each of the 4 Items Illustrated





*How "dag" Colloidal Graphite is Used for Impregnation and Surface Coatings

At the right you find out how to win a War Bond. Here you find how **dag** colloidal graphite is used by industry for purposes other than those illustrated above.

Asbestos packing, clutch facings and brake linings are impregnated with **dag** colloidal graphite to provide the lubrication which increases both their effectiveness and their service life.

Abrasive wheels are impregnated to reduce frictional heat of operation and to make them electrically conductive elements for use in electrical grinding control circuits.

Paper is impregnated to give it electrical conductivity, to reduce its translucence, or to color it.

Electrical insulation (final layers) is impregnated to reduce corona on windings of electrical machines.

The fabric in laminated plastics used in bearings, bushings, etc. when impregnated produces less frictional resistance and has a much longer service life.

Impregnating textiles, ropes and cables reduces interfiber friction and gives the materials greater resistance to wear.

Porous bearing metals impregnated have a lower coefficient of friction and maximum service life.

Coating drive belting with colloidal graphite makes it possible to bleed-off static charges of electricity.

*A TYPICAL APPLICATION

Write for free bulletin No. 431, E. "**dag** Colloidal Graphite for Impregnation and Surface Coatings."

How to Win

Acheson Colloids Corporation will give a $25.00 War Bond to each of the 5 people who submit complete and accurate answers together with the 5 best letters on the question, "Why is **dag** colloidal graphite important in the manufacture and/or use of each of the products pictured here?" (1) State business connections (no one in the graphite field or their families is eligible). (2) All entries must be legible. (3) All entries must state the publication in which the advertisement was seen. (4) Entries must be postmarked not later than September 15, 1943. (5) In case of ties, duplicate awards will be made. (6) Entries become the property of the Acheson Colloids Corp. (7) The verdict of the judges will be final.

These are two of the War Bond winners. Others will be introduced in subsequent issues.

Mr. C. J. Krister, member of the research staff of E. I. du Pont de Nemours & Co., Inc., Grasselli Chemicals Dept., Wilmington, Delaware.

Mr. J. William Glenn, Chief Chemist, General Chemical Company, Buffalo Works, Buffalo, New York.

dag COLLOIDAL PRODUCTS

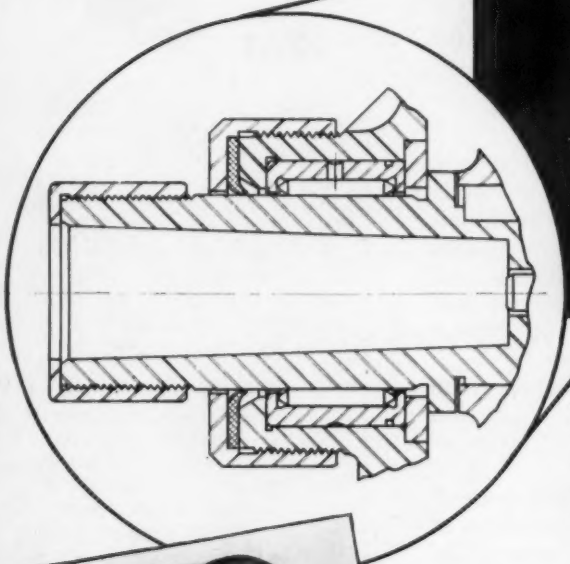
ACHESON COLLOIDS CORPORATION

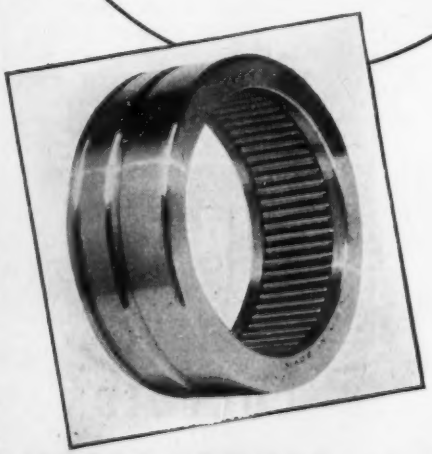
PORT HURON MICHIGAN

"...use of your roller bearing, acting on a large area of the work spindle, reduces the wear so that we have practically no replacements on them."

The Rotor Tool Co.

RBC
NEEDLE BEARINGS





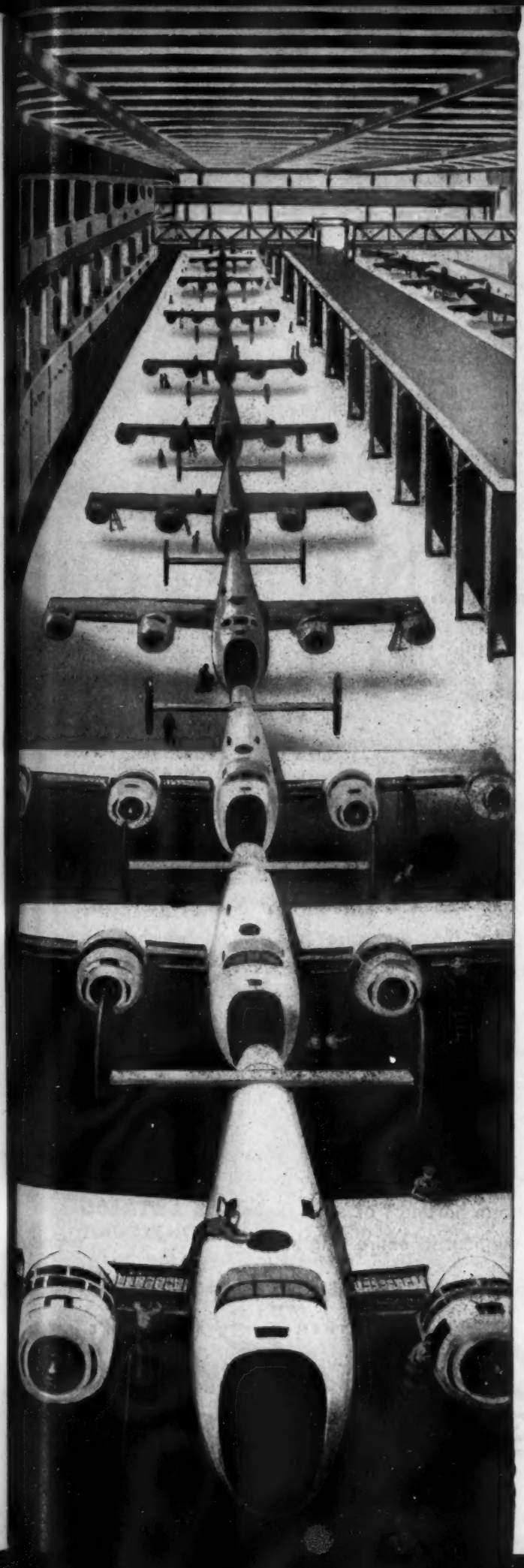
While the motor in this Rotor Tool Air Drill operates at high speeds, the work spindle traveling in an RBC CYCLOPS Needle Bearing runs at comparatively low speeds and develops high torque. This RBC Bearing, with a full complement of rollers, minimizes the wear on the work spindle that would ordinarily occur and require frequent replacement.

Then too, the basic construction of the RBC CYCLOPS provides for minimum overall dimensions and maximum carrying capacity — a contributing factor in this statement made by The Rotor Tool Co., " . . . the modern rotary type tools, such as we build, are so much lighter in weight than the older types of machines that frequently the job requires one man where it used to take two, and one operator can turn out 50% to 60% more work with the lighter tool."

Can you find here a clue to more efficient operation of the equipment you build? We'd be glad to have you consult with our engineering staff.

ROLLER BEARING CO. of AMERICA

TRENTON . . . . NEW JERSEY



DeWALT

CUTTING MACHINES help speed deliveries

Off the assembly lines they move with record-breaking speed, more and more fighters, bombers, transports and gliders. There—in the background—are DeWalt Cutting Machines supplying the speed and accuracy so essential, increasing volume, saving man-power. Sturdy, flexible, dependable—these machines do their work with a precision heretofore unknown.

DeWALT PRODUCTS CORPORATION
LANCASTER PENNSYLVANIA

CUTTING MACHINES

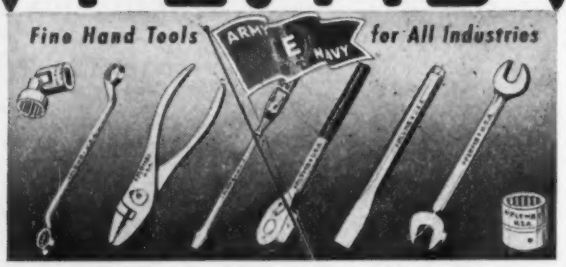
. . . professional mechanics choose **Plomb** *Tools*

Throughout war industries today, Plomb tools of all kinds and sizes are helping build weapons to defeat the enemy. From the familiar screwdriver to intricate socket and attachment sets, outstanding performance and dependability have made them the choice of experts for better, safer, longer-lasting service.

These famous tools are available through the Plomb dealer in your community. Call him for the tools you need on your war job.

Remember Plomb performs a double service—consult Plomb Tools Contracting Company for special tools; call your Plomb dealer for regular ones.

PLOMB



PLOMB TOOL COMPANY
LOS ANGELES ▽ CALIFORNIA

DO YOU KNOW WHAT THIS CANT FILE CAN FILE?

We have always considered it "unfair discrimination" to call this useful member of the file family a CANT file. Its triangular section, with one side wider than the other two, and double cut all over, makes it a "can" file for narrow flat surfaces as well as for a greater variety of acute angles than any other triangular file, and also for corners, notches and grooves.

Besides, like all other "American Swiss" Swiss-Pattern Files, it is a "can" file for *fast* work because of its clean, sharp, long-wearing teeth; and for *accurate* work because of the uniform hardness of each file throughout its entire length.

FREE CATALOG
SENT ON REQUEST

American Swiss File & Tool Co., Elizabeth, N. J.

ASK FOR THEM BY NAME

American Swiss ★✠★

SWISS PATTERN FILES

Mahon Fabricated WELDMENTS

To guard against the occurrence of imperfections, Mahon mounts for these guns are subjected to exacting Magnaflux and X-ray tests.

U. S. Navy Bofors 40 mm. Anti-aircraft "TWINS" and "QUADS" are Cradled in MAHON *Welded Steel* GUN MOUNTS

● Official endorsement by U. S. Navy engineers of gun mounts fabricated from steel plate conclusively signifies the merit of Mahon *welded* construction for this important fitting. Lighter—smoother—yet exceedingly rugged—these gun mounts must withstand terrific punishment—must successfully "take" the shock of continuous, rapid firing from a pair of high-powered guns. Extensive and modern facilities enables Mahon to turn out these mounts in ever-increasing volume.

THE R. C. MAHON COMPANY

DETROIT CHICAGO

Fabricators of Machine Bases and Frames and Many Other Welded Steel Plate Products

Each twist of the wrist bites off a burr

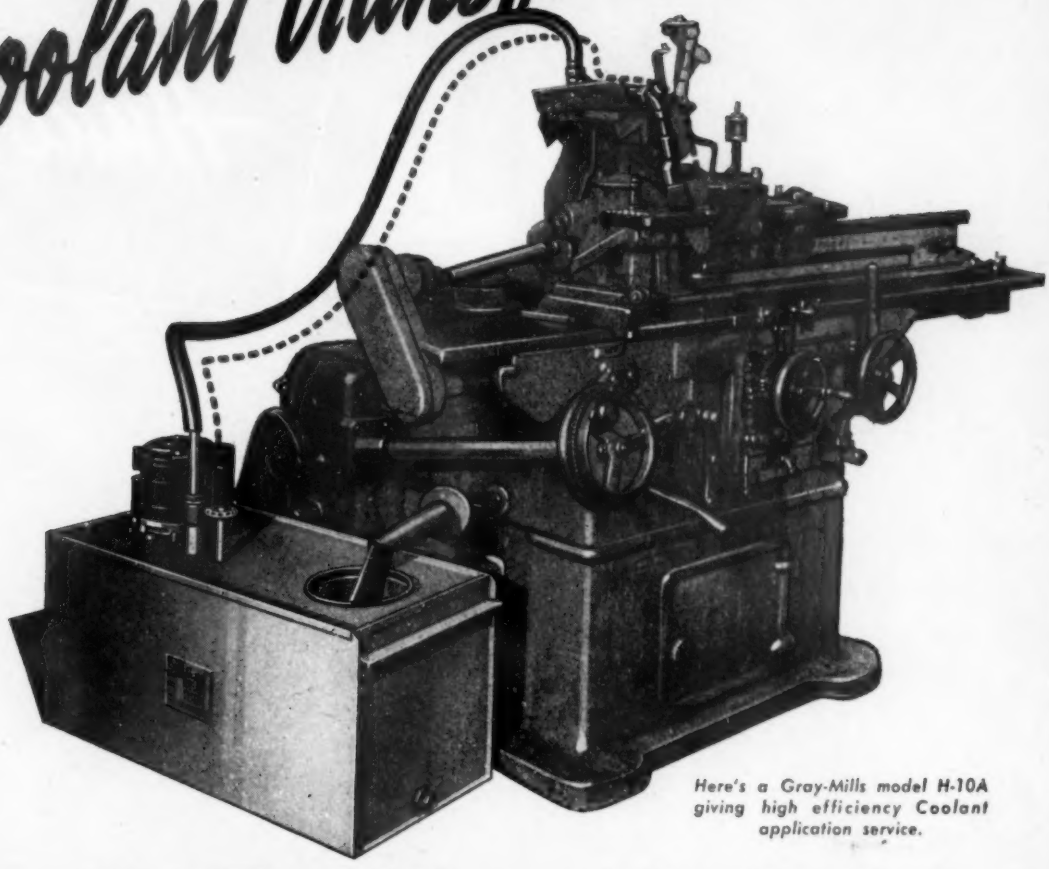
Here you see one of the new Severance family of remarkably useful deburring tools. With a twist of the wrist this Severance Hand Radius Deburring Cutter easily bites off the burr or sharp edge left by a drill or punch. It does not countersink the hole. Available in a wide range of sizes with radius or ball nose. Special shapes, to solve your individual problem, are available upon request.

For prices and complete information about these money-saving, time-saving tools write to Severance Tool Industries, Inc., Saginaw, Michigan.

Severance

SEVERANCE TOOL INDUSTRIES INC., SAGINAW, MICHIGAN.
PLANTS IN LONG ISLAND CITY, NEW YORK; CHICAGO; DETROIT; FORT WAYNE, INDIANA; LOS ANGELES

a coolant transfusion...



Here's a Gray-Mills model H-10A giving high efficiency Coolant application service.

...to increase Tool Life and Production

GOOD machines can be made to do a better job by giving them a Coolant "Transfusion." And the simplest, most efficient way to apply these production-increasing, tool-saving coolants is with Gray-Mills "Controlled Flow" Portable Coolant Systems.

Gray-Mills Systems have increased the efficiency of hundreds of machines on operations like drilling, milling, sawing, grinding, honing, tapping, threading and cutting. They are quickly and easily set up to operate either as a permanent or temporary part of a tool. Sturdily built Gray-Mills Coolant Systems are available in both gear and centrifugal types, with capacities from 50 to 2,000-gal. per hour — controlled flow. Prices range from $39.50 to $189.50.

If you want to modernize your older machines—equip small, large or special tools for greater efficiency—or have a "standby" and "cleanout" system there is a Gray-Mills for the job. Call your distributor or write direct.

GRAY-MILLS CO. • 227 W. Ontario St., Chicago, Ill.

PROMPT DELIVERIES

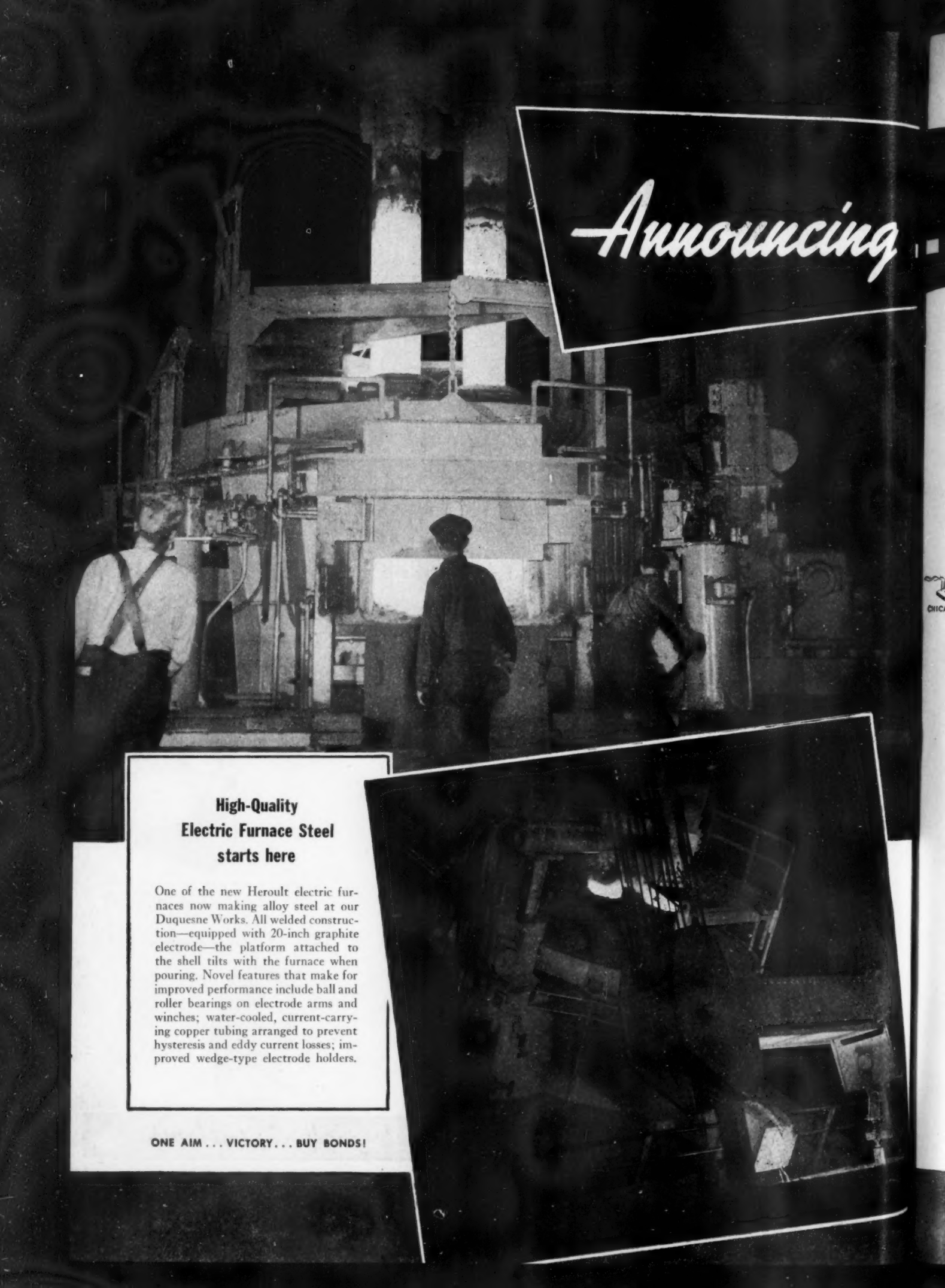
Send for the new Gray-Mills Catalog— it gives full details.

STANDARD HEAVY DUTY "A" SERIES—with large capacity tanks incorporating baffles and screens. Capacities up to 165 gals. per hour —pressure, 50 lbs. p.s.i.

MODEL "G" SERIES — capacities up to 130 gals. per hour — pressure, 30 lbs. p.s.i.

GRAY-MILLS . . . complete portable coolant systems

Use GRAY-MILLS COOLANTS . . . 5 types for most requirements—10 and 55 gal. containers—immediate delivery from your distributor or our plant.



High-Quality Electric Furnace Steel starts here

One of the new Heroult electric furnaces now making alloy steel at our Duquesne Works. All welded construction—equipped with 20-inch graphite electrode—the platform attached to the shell tilts with the furnace when pouring. Novel features that make for improved performance include ball and roller bearings on electrode arms and winches; water-cooled, current-carrying copper tubing arranged to prevent hysteresis and eddy current losses; improved wedge-type electrode holders.

ONE AIM . . . VICTORY . . . BUY BONDS!

New, greatly increased Electric Furnace capacity to serve the East with quality alloy steels

IMPORTANT to every user of alloy steel in the Eastern area is the recent expansion of our electric furnace capacity at Duquesne, near Pittsburgh.

Now in operation, this large and thoroughly modern plant brings to your very door-step, facilities for rolling, annealing and heat-treating a complete range of fine electric furnace steels in all commercial forms.

Equipment throughout, from raw materials handling to finish processing, embodies the most advanced ideas in electric steel production.

High-efficiency Heroult electric furnaces of the very latest type assure top metallurgical performance. With capacities ranging from 7 to 70 tons each, they provide a wide degree of flexibility to handle both large and small orders.

Soaking pits are provided with automatic combustion control to insure greater uniformity in heating the steel. A seven-chamber continuous annealing and heat-treating furnace, automatically controlled, insures superior physical properties in the heat-treated product. It is supplemented by batch type furnaces for handling larger bar sizes and special heat-treating requirements.

The auxiliary equipment is of the latest, most improved design and is adequate to meet the many and various needs of the alloy steel user.

Equipment facilities are matched in calibre by the skill of experienced mill and metallurgical personnel whose constant watchword is "Quality First."

Now ready to expedite the servicing of your wartime needs for electric steels, this new plant will, in the future, be ready to serve your peacetime requirements—both in small and large tonnages—with the same high quality for which U·S·S Carilloy Steels are noted.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

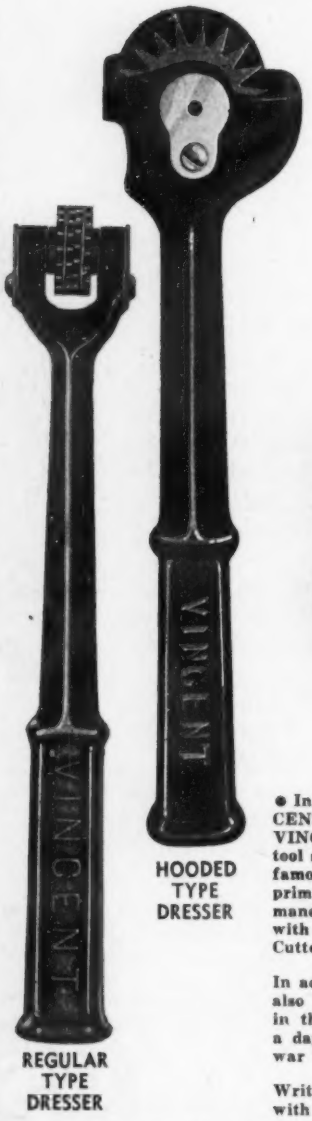
USS

UNITED STATES STEEL

MEMO

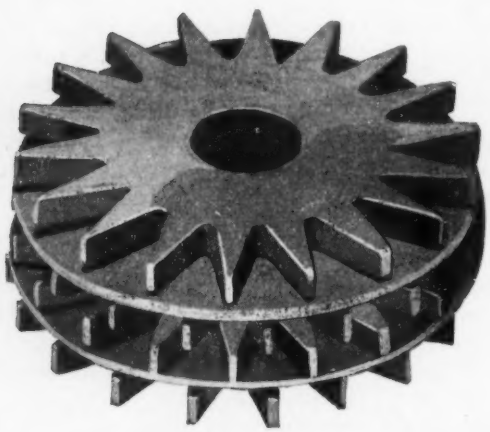
How to get Increased Production from Grinding Wheels

- Dress grinding wheels regularly to remove impregnated metals.
- True them regularly to square off face and remove nicks.
- Use equipment that will do the job properly . . . VINCENT-HUNTINGTON Grinding Wheel Dressers and Cutters.



REGULAR TYPE DRESSER

HOODED TYPE DRESSER



● Increase your war production grinding efficiency with VINCENT-HUNTINGTON Grinding Wheel Dressers and Cutters. VINCENT-HUNTINGTON Cutters are made of high-carbon tool steel . . . teeth are milled—and they are heat-treated by the famous "Vincent Process" to a specific hardness. Hundreds of prime and sub-contractors are meeting difficult production demands and keeping grinding wheels cutting at top efficiency with VINCENT-HUNTINGTON Grinding Wheel Dressers and Cutters.

In addition to making Grinding Wheel Dressers and Cutters, we also operate two of the largest production heat-treating plants in the United States. These two plants are working 24 hours a day, 7 days a week, and turn out approximately 300 tons of war work daily.

Write today for our catalog sheet which shows all the tools with standard sizes and dimensions.

"If it's a Huntington Dresser or Cutter Vincent Makes It"

THE VINCENT STEEL PROCESS CO. BELLEVUE AT VERNOR DETROIT 7, MICHIGAN

KNOW YOUR MATERIALS AND HOW TO WORK THEM

★

. . . send for these reprints of practical production data.

15¢ PER COPY

1 Working of Aluminum Alloys
2 Working of Magnesium Alloys
3 Working of S A E Nickel Alloy Steels
4 Working of Stainless Steels
5 Working of National Emergency Steels
6 Alternate Steels for Emergency Use
7 Working of Carbon Sheet Steel
8 Working With Cutting Fluids

● Here, in compact, easy-to-use form, are digests of authoritative Metal-Working practice followed in war-busy plants. Each reprint appeared originally as one of the well-known *American Machinist* "blue sections." Each details characteristics of a particular material or group of materials . . tells what they are and how to work them. Production executives find these compilations useful in employee training.

Check over the list above . . . if you want any reprints order them now while our limited supply lasts. Coupon below for your convenience.

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Enclosed is $..... (stamps, money order or check) for the following "Working of Materials" reprints. (Price 15¢ each)
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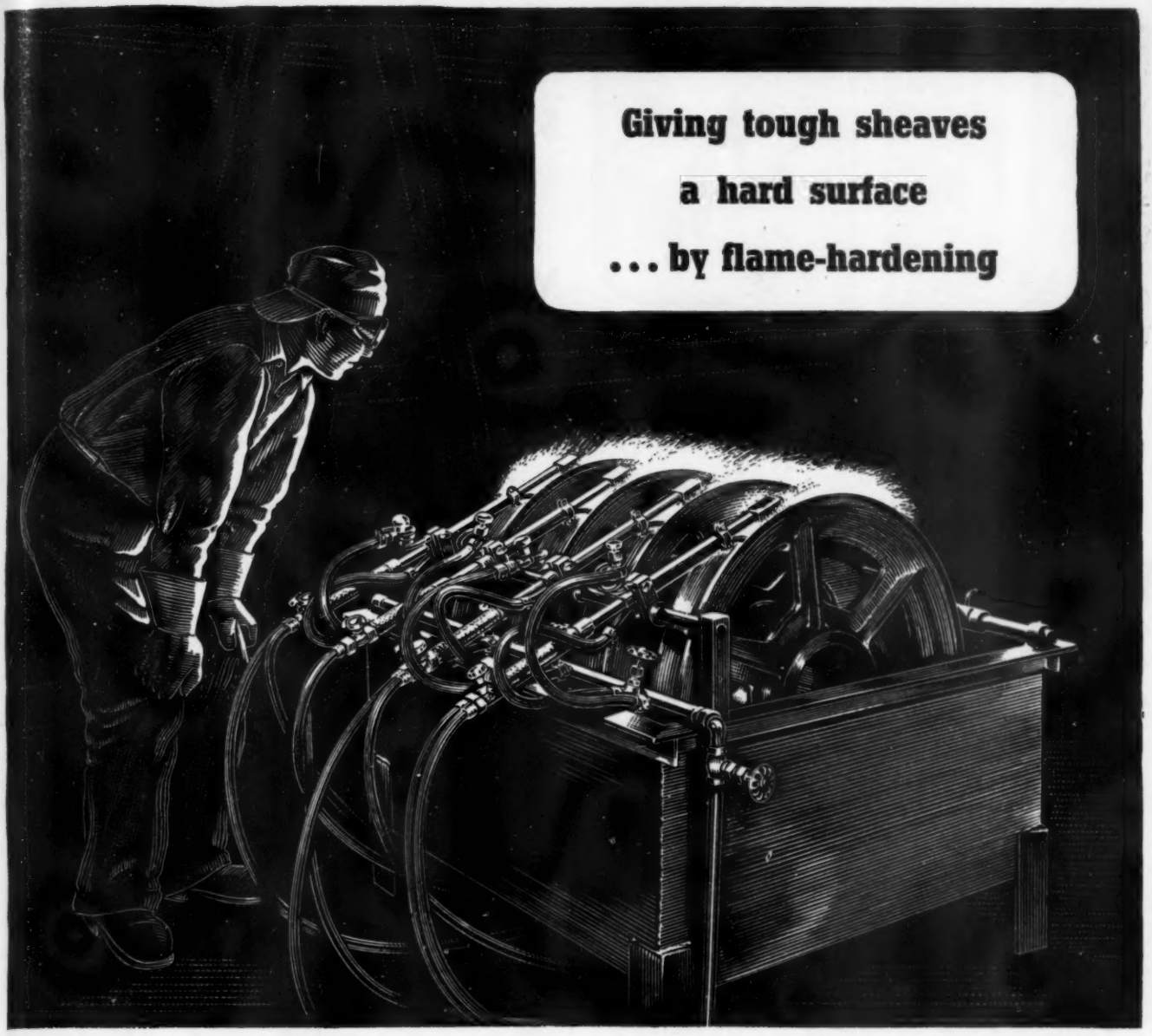
AMERICAN MACHINIST
330 W. 42 St., New York, N.Y.



CABLE sheaves made of tough steel are extremely vulnerable to wear in the cable grooves. To give the unprotected areas the surface hardness needed for long life, without affecting the core metal, this manufacturer employed flame-hardening in the unusual manner shown above.

The sheaves are set in a small tank and ride on two rollers which are driven by shafts. Shaft speed is set at 4-1/2" per minute, so that even different size sheaves are rotated at uniform speeds during the heat application. Standard Airco torches are used with special Airco flame-hardening tips which have water cooled extension tubes and a secondary quench under each tip extension.

By means of this production hardening set-up, four sheaves are flame-hardened simultaneously—72 in an eight-hour day.

This application is typical of the unusual flexibility which this modern surface hardening method provides. With flame-hardening, most common steels may be hardened to an easily controllable depth without harming the core metal properties.

If you want additional information on flame-hardening, get in touch with your nearest Air Reduction office. Airco field engineering specialists will be glad to assist you with application details.

Buy United States War Bonds

AIR REDUCTION

AIRCO

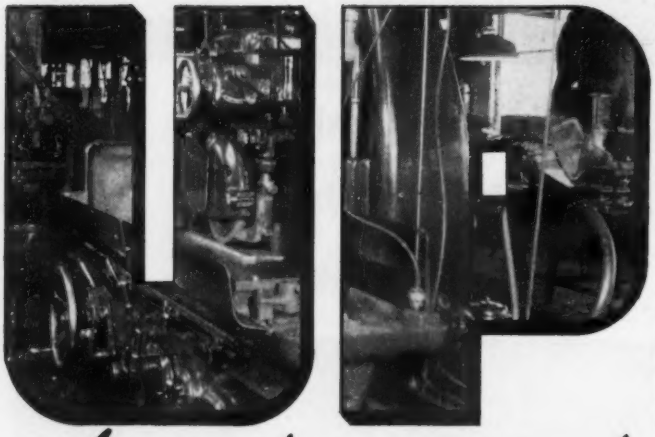
General Offices:

60 E. 42nd STREET, NEW YORK 17, N.Y.

In Texas:

Magnolia-Airco Gas Products Co.
General Offices: HOUSTON, TEXAS
OFFICES IN ALL PRINCIPAL CITIES

IDLE CYLINDERS ARE PRODUCTION SLACKERS: KEEP 'EM ROLLING FOR VICTORY!



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YOUR HYDRAULIC EQUIPMENT

***with* WARCO HYDROIL!**

Performance on all types of hydraulically operated systems more closely adheres to new machine productivity when you use Warco Super and E.P Hydroils. New smoothness and efficiency of operation plus stepped-up production result from the following eight operating advantages:

1. Reduced friction and wear; 2. Extra service life; 3. Ease of operation; 4. Easy cold starting; 5. Clean reservoirs, pumps, and valves; 6. Decreased maintenance costs; 7. Uniformity of product; 8. Increased economy.

Warren pioneered the production of "extreme pressure" inhibited hydraulic oils. Its extensive laboratory knowledge of fortified lubricants and the skill of its field engineers in the application of hydraulic fluids together with a complete line of Warco Super and E.P. Hydroils assure you of trouble free operation of all types of hydraulic equipment.

A seventy page manual, "Controlled Maintenance Plan For Hydraulic Systems," is available free on request. It is full of valuable information.

Send for it today.

Specialized PRODUCTS

THE WARREN REFINING AND CHEMICAL CO.
CLEVELAND 5, OHIO

ALLOY

S.A.E. HY-TEN N.E.

STEELS

We solicit your inquiries

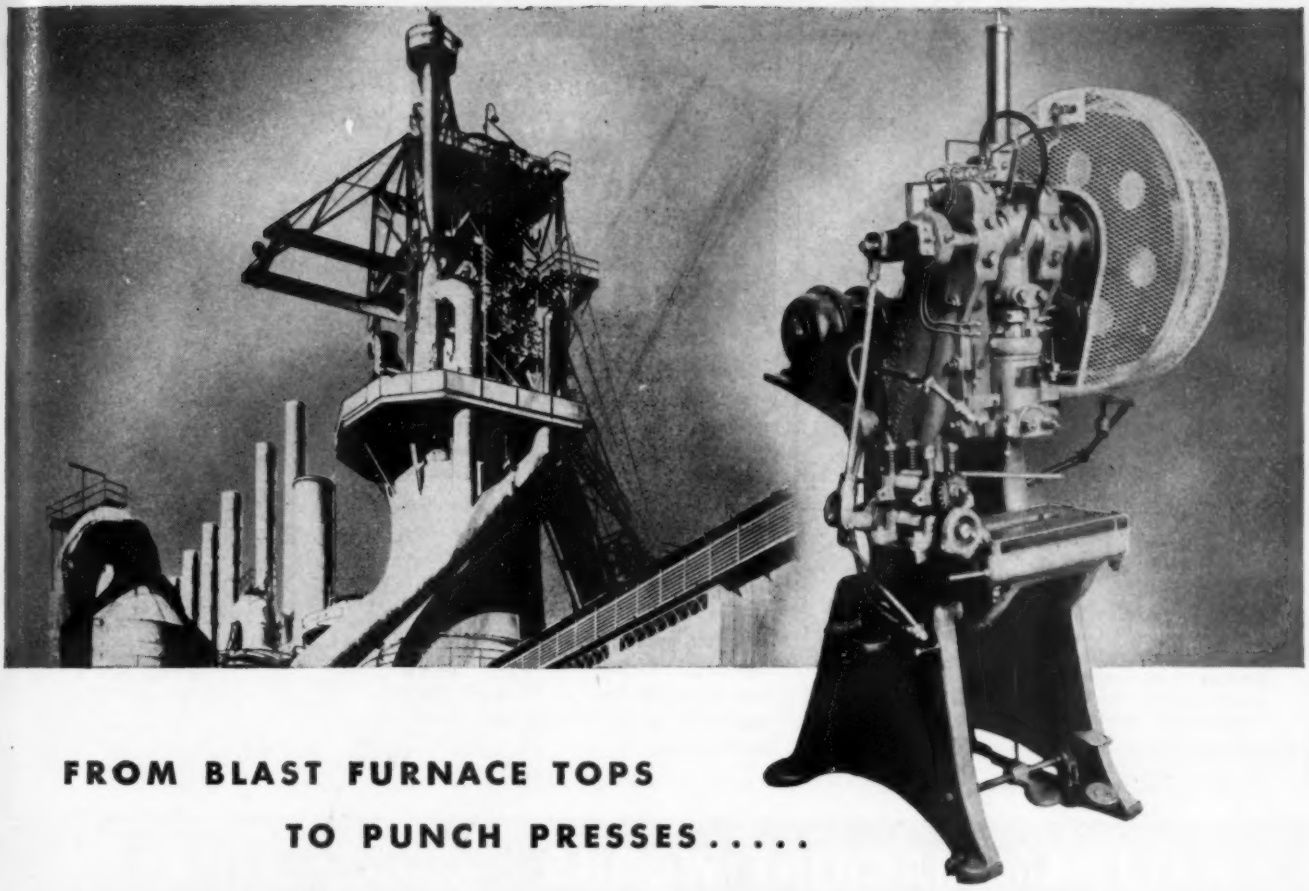
Even though warehouse stocks today are not as plentiful as you and we would like there are still a substantial number of sizes in a variety of analyses available for immediate shipment. We will do everything within our power to help you make the guns and tools and ships and planes and tanks which will win the war.

Wheelock, Lovejoy & Co., Inc.

Main Offices: 137 Sidney St., Cambridge, Mass.

Cleveland, Chicago, Newark, Detroit, Buffalo, Cincinnati

Is this YOUR Cleaning Problem?
DEGREASING STAINLESS STEEL PARTS
To speed output of stainless steel parts, effective cleaning is indispensable. That is why we say . . . use a recommended Oakite degreasing material in your cleaning tank or automatic washing machine . . . and you'll find you can remove cutting and grinding oils, drawing and forming lubricants, shop dirt, etc. FASTER and EASIER!
FREE for the asking, a NEW Special Service Report gives data on this and such other essential, related operations as machining, grinding, drawing and forming. Write for YOUR copy TODAY!
OAKITE PRODUCTS, INC., 24 Thames St., NEW YORK
Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada
OAKITE CLEANING



FROM BLAST FURNACE TOPS

TO PUNCH PRESSES.....

TRABON LUBRICATING SYSTEMS

Meet EVERY Industrial Lubricating Requirement

● On blast furnace tops, overhead traveling cranes, costly steel mill equipment, forging presses, brakes, shears, machine tools and other lighter duty machinery,— install Trabon Lubricating Systems.

Trabon Lubrication makes absolutely certain that every connected bearing, whether large or small, receives just the desired amount of lubricant, *while the machine is in operation.* Trabon avoids the costly down-time while an oiler crawls over the machine to lubricate each bearing individually,— and the break-down if he misses one. Trabon prolongs bearing life, minimizes machine tie-ups—reduces accidents and compensation costs.

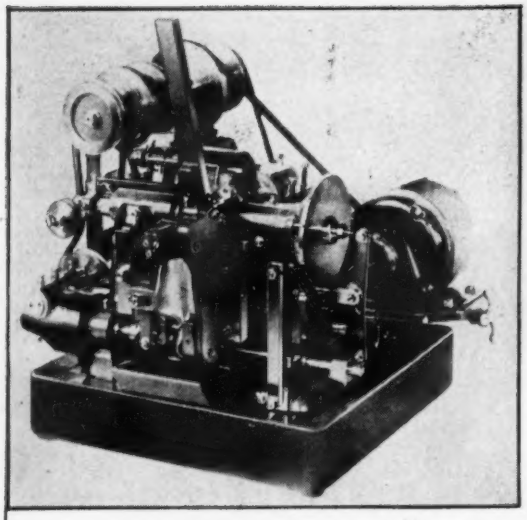
Thoroughly dependable, and less costly operation, are only two advantages of Trabon Lubrication. The use of fully enclosed "feeders" that have no exposed moving parts to corrode or get bent,—easy installation,—and the ability to place the feeders in the most advantageous position available, whether high overhead or under the floor, are some of the others. You'll find full details in our recently issued, fully descriptive Engineering Bulletins. Send for copies today.

TRABON

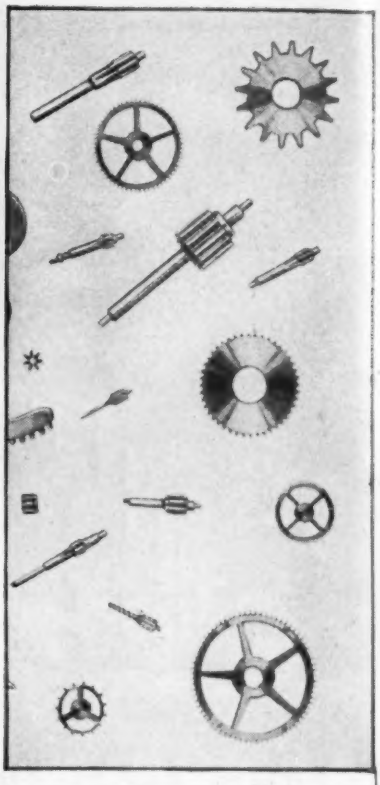
ENGINEERING CORPORATION

1819 East 40th Street • Cleveland, Ohio

INDUSTRIAL LUBRICATION EXCLUSIVELY SINCE 1922



HIGH PRECISION PRODUCTION . . .
assured by
WALTHAM
PINION AND GEAR
CUTTERS



SPECIFICATIONS

PINION MACHINES
Diameter capacity (approx.) — ½".
Coarsest pitch (about) 32 D.P.
Strokes of work slide for pinions .25" to .45".
Strokes of work slide for stacked gears .85" to 1".
Bench space (countershaft drive) 19" x 18".
Bench space (motor drive) 26" x 25".

GEAR MACHINES
Pitch diameter, capacity 1½".
Strokes for work slide: 40", .65", 1.00", 1.25".

Small parts are cut to tool room standards of precision on these WALTHAM machines which are available in single-cut, multiple-cut and magazine-feed types. The typical parts for watches, meters, time fuses, instruments, gauges, etc., shown here give an idea of the wide range of parts which can be cut to high precision on Waltham machines.

As in all Waltham machines, a revolving cutter makes successive cuts held and indexed by work spindle. Operation is extremely simple and no special skill is required to cut pinions and gears to rigid specifications.

Send at once for complete details.

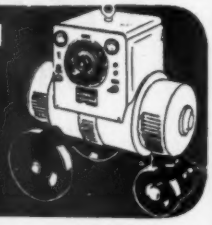
WALTHAM MACHINE WORKS WALTHAM MASS. WALTHAM TRADE MARK REGISTERED U.S. PAT. OFF.

For Greater Output, use...

Features like balanced design, end-to-center cooling, 4-pole exciter, straight or reverse polarity at the flip of a switch, dual control for 1,000 "heat" combinations and Remote Control . . . all make Hobart a giant at its work.
HOBART BROS. CO., Box AM-83 TROY, O.

HOBART... *One of the World's Largest Builders of Arc Welders*

HOBART
ARC WELDERS
Free Catalog sent on request



AIR and HYDRAULIC
Hanna Cylinders
Dependable power for pushing, pulling or lifting. Standard models, air or hydraulic, low or high pressure, for all requirements. Write for full details.
HANNA ENGINEERING WORKS • 1767 ELSTON AVE., CHICAGO

ALADDIN ROD ALADDIN ROD
Patent No. 2055360 NO FLUX NO ACIDS
DOES IT QUICKER, BETTER, MORE ECONOMICALLY
WELDS ZINC BASE DIE CAST and BRAZES ALUMINUM
Repairs KIRKSITE and other zinc base dies, with die in either horizontal or perpendicular position. Unexcelled for use on sheet or cast aluminum, saves time and heat. Complete instructions with each pound. Sizes 1/16", ⅛", 3/16" and ¼" also complete assorted lb. WRITE FOR FREE LITERATURE.
ALADDIN ROD & FLUX MFG. CO.
Box 935 Mad. Sq. Sta., Dept. G Grand Rapids, Mich.

Stuart's "SUPER-KOOL" # M SERIES HONING OILS

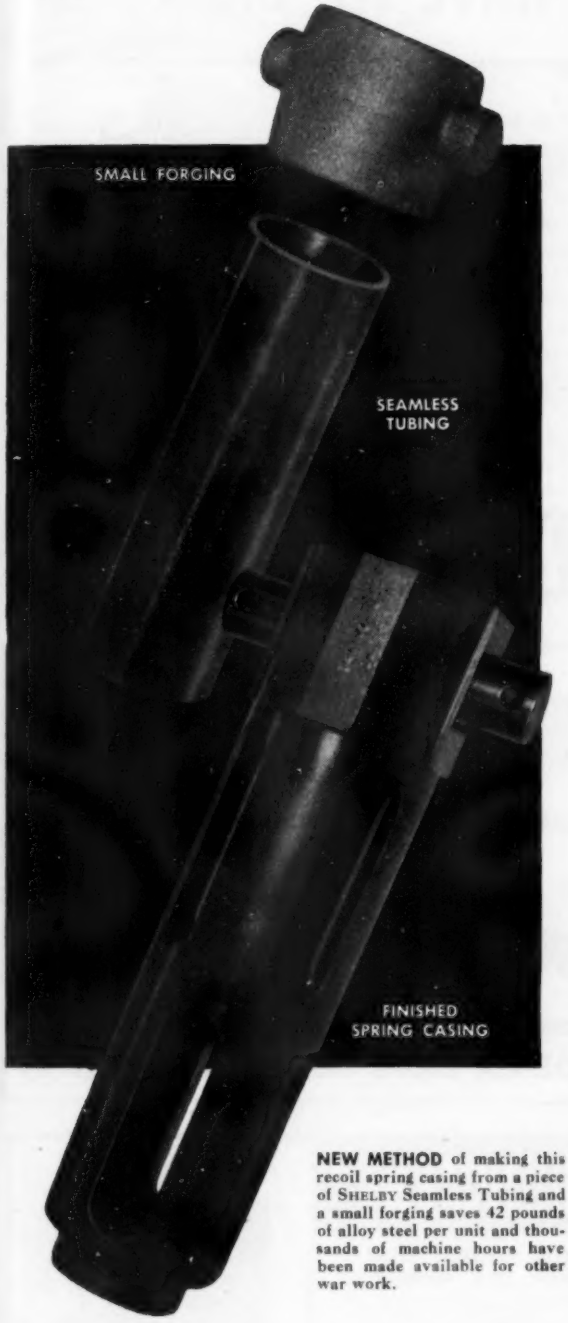
. . . developed to help you achieve better honing!

THE popularity of Stuart's "Super-Kool" Honing Oils has increased in proportion to the rapid rise of honing operations. "Super-Kool" uniformity and quality insures better honing . . . proved advantages and quick availability rule out any necessity for hit-or-miss, homemade "mix-moxes". Try "Super-Kool" Honing Oils on your honing operations. A Stuart engineer will be glad to help you properly apply them. Ask him to call.

For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in Principal Metal Working Centers

HERE'S AN IDEA...

that saved hundreds of tons of alloy steel!



NEW METHOD of making this recoil spring casing from a piece of SHELBY Seamless Tubing and a small forging saves 42 pounds of alloy steel per unit and thousands of machine hours have been made available for other war work.

AN automobile manufacturer was given the job of building anti-aircraft guns . . . in a hurry. The recoil spring casing was made from a solid alloy steel forging weighing 56 pounds. The finished part weighed only 6 pounds. The other 50 pounds of precious alloy steel were tossed into the scrap barrel.

This was the European method of making guns, but it didn't look good to the American design engineers. Too slow . . . too costly . . . too much waste. They began to search for a faster, more economical method . . . and soon found it.

By welding a section of Seamless Steel Tubing to a small forging, the total weight of the piece was reduced to 14 pounds. *Only eight pounds* of metal had to be removed to produce a casing that duplicated the original in size, weight and strength. This made a net saving of 42 pounds of high grade alloy steel or 75% of the original weight of metal.

Already the new design has released hundreds of tons of alloy steel for other war purposes and thousands of valuable machine hours have been made available for other war production.

This is but one of many instances where the use of SHELBY Seamless Tubing instead of solid forgings has resulted in tremendous savings in time, materials and labor. Tubular drive shafts for automotive equipment, tubular landing gears for airplanes, and tubular gun mounts made similar weight savings. Such improvements cut the cost of war materials—make the dollars spent for *War Bonds* stretch to the limit.

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Completely Automatic • One Push-Button Control
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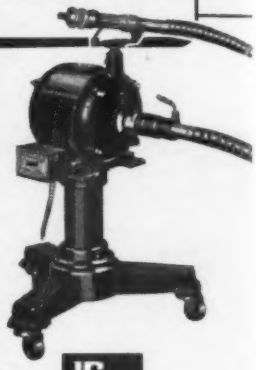

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VERTICAL MOTORS WITH DRIP-PROOF COVERS

Vertical *Uni-Shell* Motors with drip-proof cover and special base. A wide variety of flanged end heads, ring, and tripod bases are available.

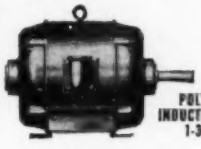
The vertical D. C. motor is made drip-proof with special end head covers. All flanged heads or lower bases developed for other types are available for D. C. frames.

Vertical type of capacitor-start induction run motor with drip cover and external capacitors. All flanged heads are completely interchangeable for all motor types.

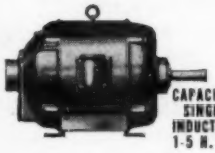
All of the motors shown above use the same flanged head, but many other flanges, standard and special, can be supplied. It is important to remember that such heads are interchangeable for Single-Phase D.C. and Polyphase motors.

ONLY END HEADS CHANGE

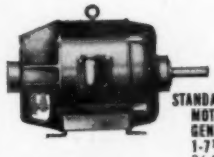
Every dimension, from Uni-Shell motor body to head fit, is identical for all motor types.



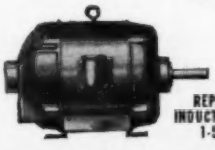
POLYPHASE INDUCTION MOTOR 1-30 H. P.



CAPACITOR-START SINGLE-PHASE INDUCTION MOTOR 1-5 H. P.



STANDARD D. C. MOTOR AND GENERATOR 1-7½ H. P. ¾-5 K. W.



REPULSION INDUCTION MOTOR 1-5 H. P.

COMPLETE INTERCHANGEABILITY IN ANY ONE FRAME SIZE

The R & M Uni-Shell Motor represents the development of a revolutionary idea in electric motor design. In all types of Uni-Shell motors, the shell length, diameter, base mounting holes, shaft dimensions, height of shaft above base, head fit and bolt circle mounting for heads are exactly the same for any frame size. Only the end opposite the shaft extension varies from one type to another and then with only a slight change in external appearance.

And even beyond this complete interchangeability, R & M Uni-Shell Motors are far in advance—the finest and longest-lived motors that R & M has built in nearly 50 years of motor specialization. Trouble-free bearings and alignment, precision-balanced rotors, new and better methods of insulation, low interior temperatures and other exclusive features are engineering achievements which bring important benefits to every Uni-Shell user. Mail the coupon for an interesting 20-page booklet on the R & M Uni-Shell line and its advantages.

Uni-Shell ADVANTAGES

1—Complete interchangeability in any one frame size.

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3—Many interchangeable flanged end heads for vertical or horizontal mounting.

4—Adaptability to drip-proof, splash-proof and totally enclosed fan cooled construction.

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Free book on Tool Steel and its Treatment

Here's a new book that will be of practical value to anyone who works with tool steel. It's called *Tool Steel Treaters' Guide* and is a "how-to" manual from start to finish.

You'll find in it specific information on how to forge, normalize, anneal, spheroidize, cool and harden tool steel. You'll find many clear, informative photographs on quenching, P-F fracture standards, hot-acid etching, and grain structure. Also, there are two full-color charts showing the actual heat and temper colors of steel, through the heating and tempering ranges.

One section of the book is devoted to definitions of some of the terms used in the steel industry—hundreds of items are defined, ranging from "Air-Hardening Steel" to "Yield Strength." These definitions should be particularly helpful to new men in war-production jobs involving the handling of steel.

Another feature of the *Tool Steel Treaters' Guide* is its section of useful tables: weights and areas of square and round bars; weight per linear foot of flat bar steel; areas and weights of different shapes of steel bars; Brinell hardness numerals; hardness-conversion tables; temperature-conversion tables; revolutions per minute for assigned surface speeds; English-metric system equivalents.

Anyone who works with tool steel will find the 116 pages of the Tool Steel Treaters' Guide *packed with usable information. The guide will gladly be furnished free of charge to anyone who is engaged in war production. Write to Bethlehem Steel Company, Bethlehem, Pa., for a copy today.*

A Few of the Subjects Covered: NORMALIZING • ANNEALING • TEMPERING • QUENCHING MEDIA • MICROPHOTOGRAPHS OF HIGH-SPEED STEELS • HEAT AND TEMPER COLOR CHARTS • DEFINITIONS OF STEEL INDUSTRY TERMS • WEIGHTS OF STEEL BARS • FARENHEIT-CENTIGRADE • CONVERSION TABLES • DECIMAL EQUIVALENTS OF AN INCH FOR EACH 64TH.

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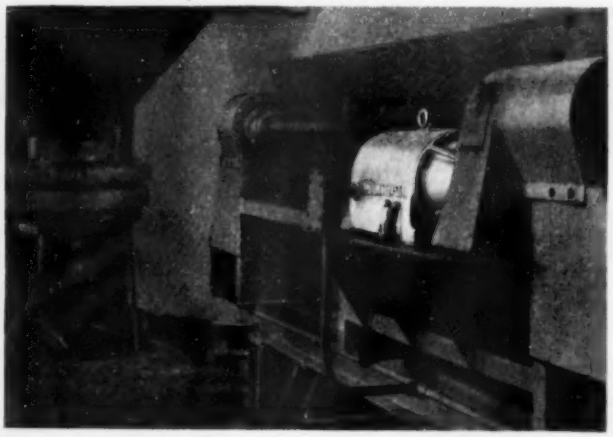

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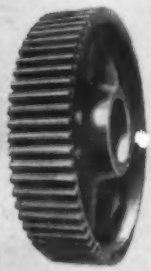

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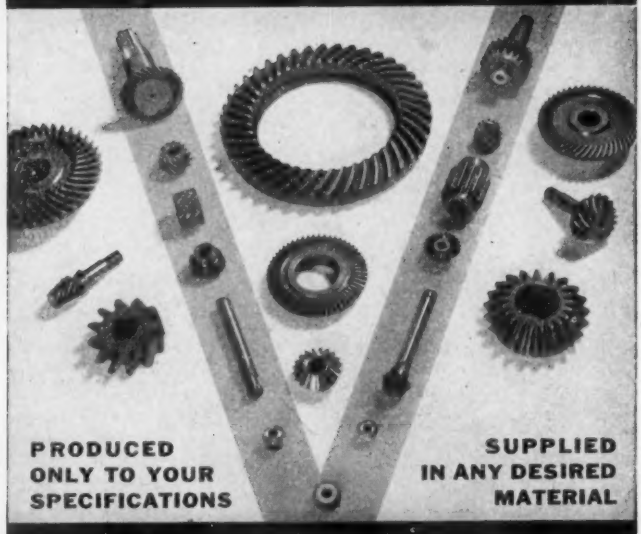

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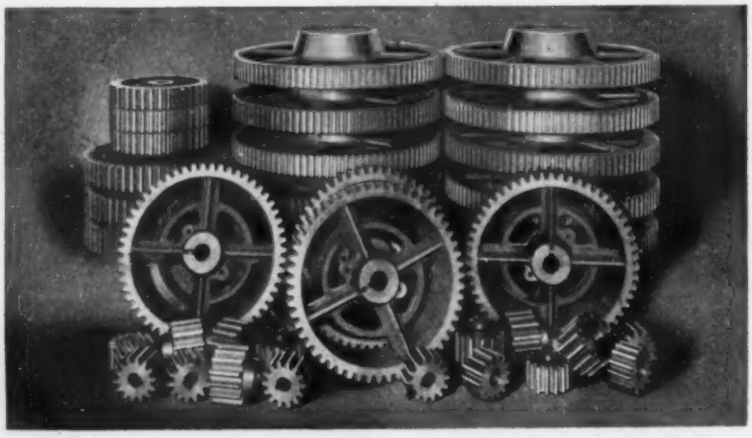

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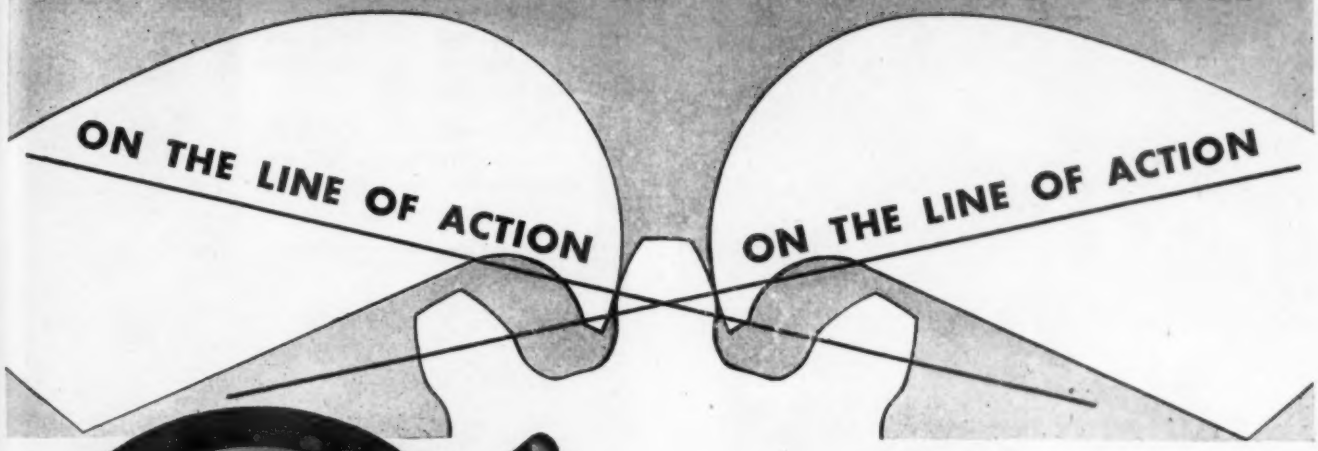

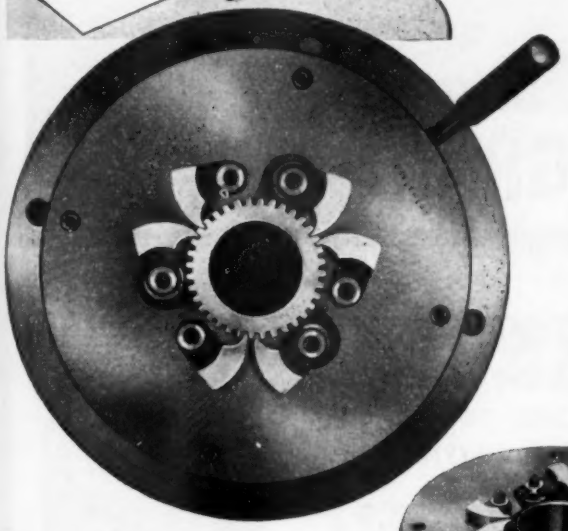

Method eliminates distortion. Gripping action distributed around circumference rather than through diameter. Principle used only in

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For grinding the hole, the hub face, or for boring most delicately constructed gears within your tolerances in relation to pitch diameter. Distance from root diameter to the hole or counterbore of any gear never presents a problem, as pressure is always against the sides of teeth, never toward the center along diameter to cause distortion.

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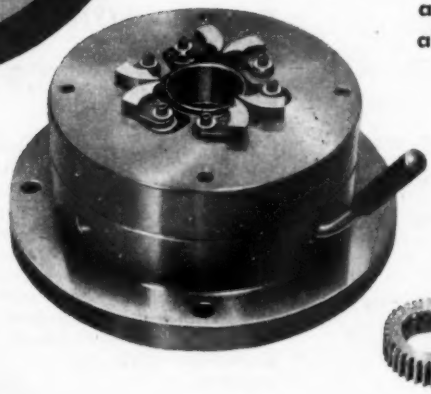

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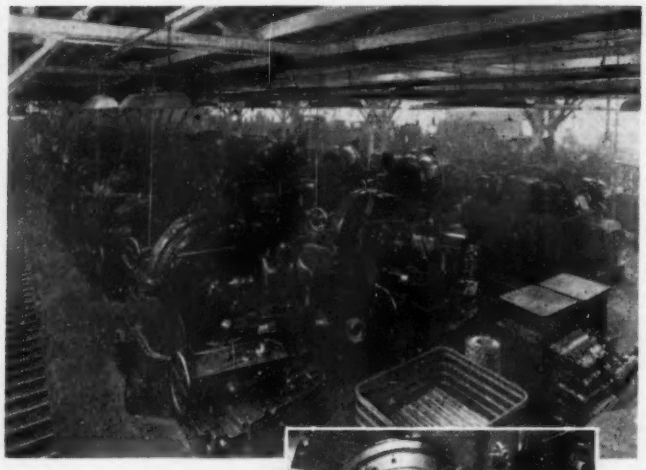

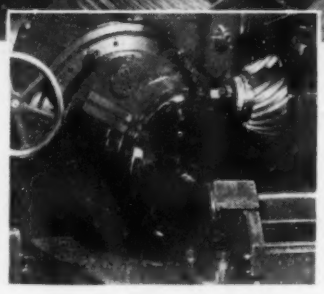

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Perhaps we can help you too. Your inquiries will be given prompt attention.

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Straight Bevel — Spiral Bevel
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"When your specifications call for special gears — Spur — Bevel — Mitres — Helical — Worms and Worm Gears —Reduction Units—Why not try GRANT.

You will find GRANT service meeting all requirements on both stock and special gears."

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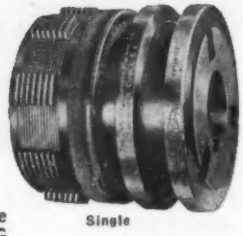
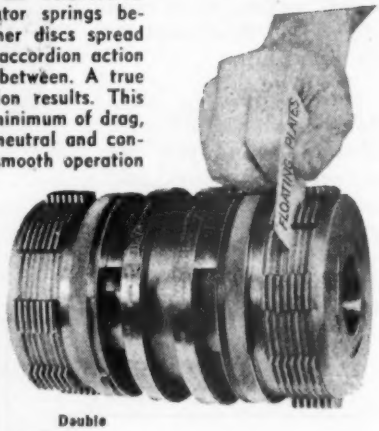
THE JOHNSON FRICTION CLUTCH

MINIMUM DRAG ASSURES COOL RUNNING WITH THE NEW "MAXITORQ"



Single

In the design and construction of the "MAXITORQ" MULTIPLE FLOATING DISC CLUTCH, separator springs between each pair of inner discs spread these endways with an accordion action so that there is space between. A true floating type construction results. This feature accounts for a minimum of drag, abrasion or heating in neutral and contributes to remarkably smooth operation as well as quick disengaging.



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Other features of performance and operation include simple manual adjustment, sensitive starting, safety and quietness. Heat and abrasion, ordinarily inherent in many clutches of the multiple disc type are eliminated in the "MAXITORQ."

Send for dimension sheets and specifications covering the sizes and types available.

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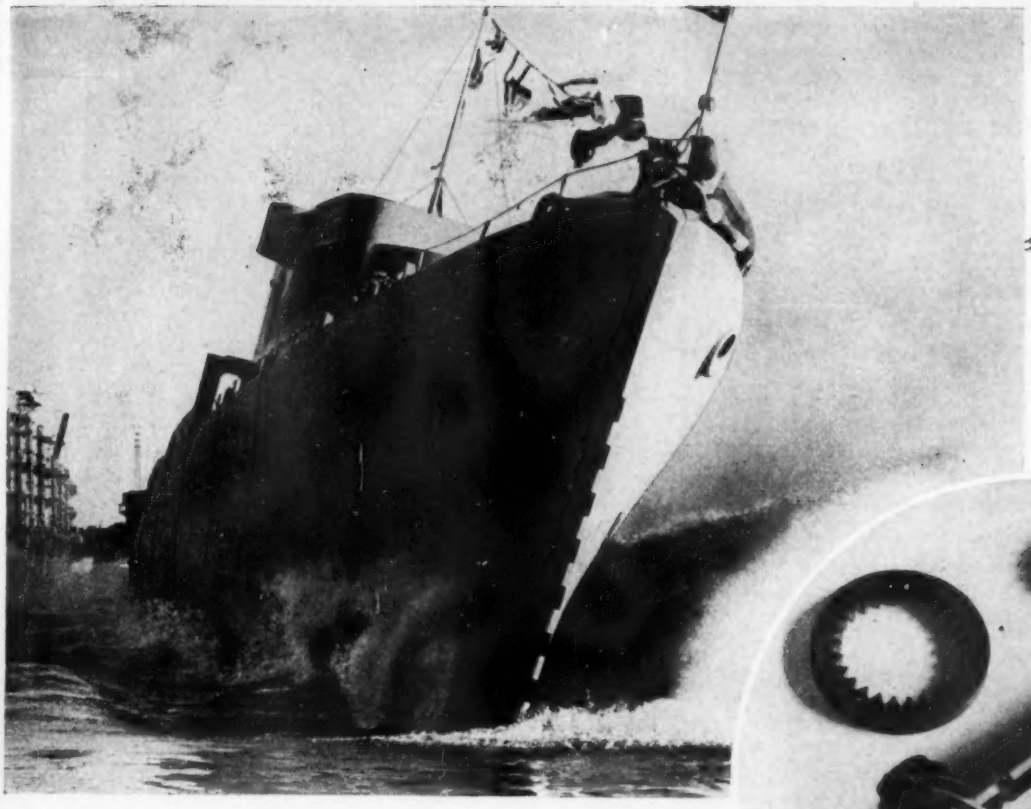

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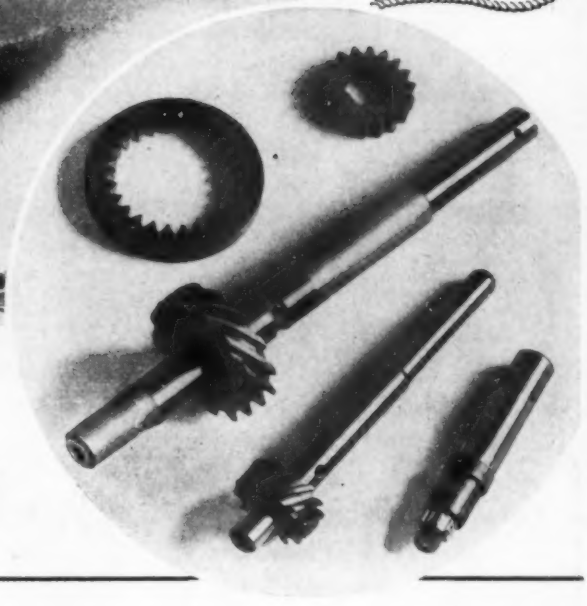

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Get power and speed with the help of OHIO CUT GEARS

● "DE's", Destroyer Escorts, are Uncle Sam's answer to the sub pack menace. They are sturdy, swift, hard-hitting. Their job is to "ride herd" on convoys, to hunt down lurking subs, to make sure that precious cargoes get through.

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Small but vital among the governor's parts are these Ohio Cut Gears. In gears such as these, of course, precision is paramount. So Marquette engineers laid down exceptionally close tolerances. Then they turned the cutting over to Ohio Gear, for they knew by experience the dependability of Ohio's precision Gear Cutting. They knew that this dependability, which had served them so well in peacetime, would give a good account when called on for fast, furious war action.

Cutting these gears for Marquette governors is another place Ohio Gear Company is proudly serving in the all-out fight.

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and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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Bevel-Spur-Worm-Helical
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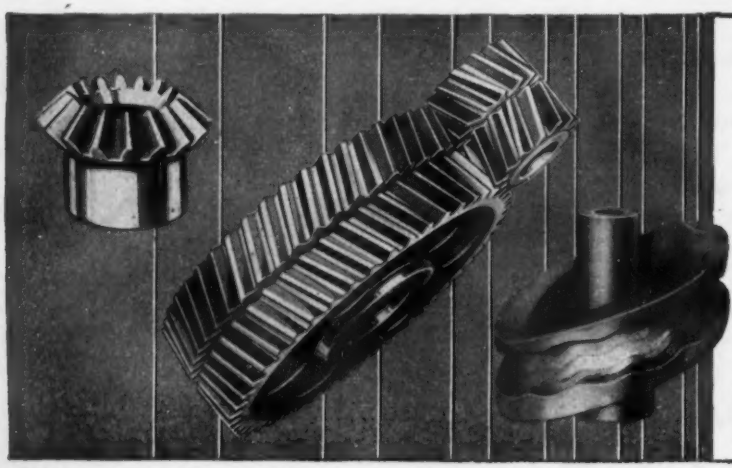

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The new K type Navy blimp is able to fly at 80 miles per hour or to hover motionless over a lurking submarine. These airships have proved an efficient answer in protecting coastwise shipping against the undersea menace.

★★★ *Guardian Angel* OF THE CONVOY

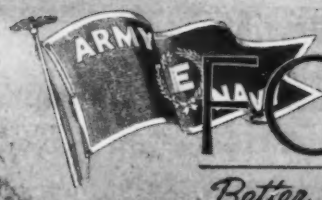
Swinging majestically over the convoy, the blimps are proving an effective answer to the submarine menace. Sinkings have been practically eliminated in convoys so guarded.

Able to scan the ocean for miles, able to see below the waves, able to hover over the slowest tanker, or to fly at many times the speed of the fastest wolf pack, these guardian angels of the fleet owe much of their effectiveness to the engines that power them.

And in these Pratt and Whitney engines, as in every part of the ship, weight is a vital factor. To produce gears of the necessary lightness—of the extreme precision that this lightness, coupled with tremendous horsepower, demands—meant a new conception in gear manufacture. Today, these gears are being produced at Foote Bros. in amazing quantities.

The new manufacturing techniques, new production know-hows that make these lightweight, high-precision gears possible, will mean better performance and greater operating efficiency when they are applied to peacetime machines.

FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 S. Western Boulevard, Chicago, Illinois



FOOTE BROS.

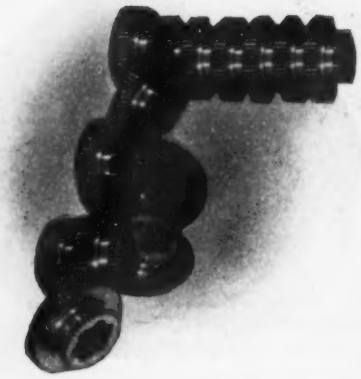
Better Power Transmission Through Better Gears

SIER-BATH HEAT TREATING

MAKES POSSIBLE *PRECISION GEARS*

of

- **FINER QUALITY**
- **GREATER UNIFORMITY**
- **UTMOST STAMINA**



The importance which Sier-Bath attaches to the heat-treating of gears is reflected in the comprehensiveness and high class of furnace and control equipment employed for this purpose. Some idea of the completeness of SIER-BATH'S modern facilities is obtained from these views of the Heat Treating Department shown here — all under the expert supervision of an operating technician of long experience.

Write, wire or phone your specifications, giving high priority.

As a vitally important service to production, SIER-BATH heat treating provides outstanding assurance that every gear will meet the most exacting demands for high uniform quality and long life under the most severe conditions of service — particularly important advantages today because, as vital parts of war equipment, gears must stand up in the field and perform their functions dependably with minimum attention. War equipment must keep rolling — time out for repairs or replacements cannot be tolerated.

When you come to Sier-Bath for gears you can be sure you will get the maximum in quality, strength and precision.

The Doorway to 38 years experience in making Precision Gears

SIER-BATH GEAR CO.

NORTH BERGEN NEW JERSEY

Incorporated

when the smoke of battle clears away!

The post-war world will be strange and new. Products hitherto unknown, or at least greatly improved, will make the scientific marvels of today seem dull and commonplace. This Company is fully prepared for that happy era. The advances in the mass production of precision, custom-cut gears have been born in the fiery crucible of war. Take advantage of the new techniques so developed by Perkins. Ensure now that you and your post-war product will be ready. Consult with our engineering staff on any problem involving the production of gears for the efficient transmission of power.

PERKINS PRECISION, CUSTOM-CUT GEARS

help power American Planes, Tanks and Guns

PERKINS MAKES:

Helical Gears	*Bevel Gears*	*Ratchets*
Worm Gears	*Spiral Gears*	*Spur Gears*

Ground Thread Worms

PERKINS MACHINE & GEAR COMPANY, SPRINGFIELD, MASS.

Rickert Shafer

FOR 35 YEARS

R-S Boring Head

Adjustable

Made in 3 sizes with .001" Micrometer Adjustment for use on any drilling, turning or boring machine tool. Each size handles a wide range of work.

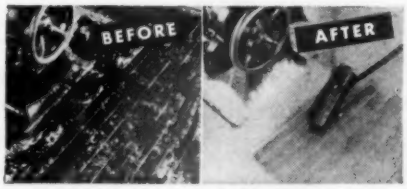
Another **R-S** second operation tool that will speed your war work. For over 35 years Rickert-Shafer has specialized in the design and manufacture of precision tools for production threading This Boring Head was developed years ago to answer a request for a simple, adjustable wide range and accurate boring tool that could be adapted to any milling machine, turret lathe or drill press. Write for complete data and be sure to indicate the priority rating of your work.

RICKERT-SHAFER CO · ERIE, PA.

DIE HEADS • COLLAPSIBLE TAPS • BORING HEADS
TAPPING MACHINES • SPECIAL THREADING MACHINES

Ever check up on your porters an hour or two after they've scrubbed and scoured the oily, greasy floors in your plant? Ever notice how, in hot weather, oil and grease "bleed" out of the old deposits, just as though the floors hadn't been cleaned at all? That's not the porter's fault. It's *your* fault. If your floors are cleaned with SPEEDI-DRI they won't bleed, because SPEEDI-DRI draws old oil stains out of wood, concrete, or metal.

SPEEDI-DRI does even more than that. It sets up an immediate non-skid surface. It acts as a fire retardant. It brightens and lightens the whole room. It saves workmen's shoes from oil-rot and helps to prevent skin diseases of the feet. It conserves vital manpower because it is easily spread by hand and as easily cleaned up. It saves time because it can be applied and removed without interrupting production. It improves employee-morale because it makes the plant a cleaner, safer place in which to work. For all-around effectiveness in oil-absorption and floor-area-covered there is no other product that can compare with SPEEDI-DRI.



Write for a generous, free sample and test it in your own plant. (If you use water soluble oils or if water is also on your floors, ask for SOL-SPEEDI-DRI.) End the menace of bleeding floors in your plant quickly, effectively, and economically with SPEEDI-DRI.

SPEEDI-DRI
OIL AND GREASE ABSORBENT

SUPPLIERS

East — REFINERS LUBRICATING CO.
New York 1, N. Y.

Midwest and South
WAVERLY PETROLEUM PRODUCTS CO.
Philadelphia 6, Pa.

West Coast
WAVERLY PETROLEUM PRODUCTS CO.
Menlo Park, Calif.

Which TYPE of V-Belt Best Fits YOUR Need?

– Special **Synthetic** Belts?

– **Steel Cable** Belts?

– **Rayon-Cord** Belts?

– **Standard** Vulco Ropes?

Phone Your Gates Field Engineer—

He Will Tell You!

If you have a drive on which a V-belt of special type may be required for greatest service efficiency, you will almost certainly find that Gates has long been building a V-belt precisely engineered to fit your needs.

In some installations, a V-belt whose tension member is composed of rayon cords will have advantages over the standard cotton cord construction. Gates has been building rayon-cord belts since 1939.

Again, Gates engineers have found that a belt built with flexible steel cables as the tension member is sometimes most economical despite its higher initial cost—and Gates has been building flexible steel cable V-belts since 1935.

For five years, the Gates synthetic rubber belt has been piling up amazing service records in large industrial plants all over the United States. Under severe conditions of heat and oil, the Gates special synthetic belt actually outwears any natural rubber belt by as much as 230%.

It might seem that it would be some trouble to determine whether a synthetic-rayon, a synthetic-steel-cable, or a standard Gates Vulco Rope would be most efficient and economical for your particular application. Actually, this involves no more than picking up your phone.

There is a Gates engineering office in every large industrial center. The Gates field engineer who consults you in answer to your phone call is thoroughly competent to analyze any drive problem you may have. He is completely informed on the nature and advantages of every type of belt. He will always recommend the practice that will be most efficient and economical for you.

438

THE GATES RUBBER COMPANY

Engineering Offices and Stocks in All Large Industrial Centers

GATES VULCO ROPE DRIVES

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Keep Your Bearings "FIGHTING FIT!"

WAR PRODUCTION . . . with many machines in almost constant operation . . . puts bearings under severe strain. Be absolutely sure that your BCA Ball Bearings are safeguarded by proper maintenance. Keep them "fighting fit"—for they're sinews of war!

BEARINGS COMPANY OF AMERICA, LANCASTER, PA.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

Standardize on Standard Sizes

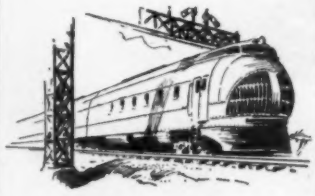
HOW TO LENGTHEN THE LIFE OF BCA BALL BEARINGS

1. Use bearings that are correctly sized for the shaft.
2. Heed the stated capacities of bearings.
3. Give bearings all possible protection from dirt and moisture.
4. Use only neutral mineral lubricants.
5. When lubricating with oil, keep only enough in the housing that the lowest ball dips in to one-half its diameter. With grease, do not have the housing more than one-half to two-thirds full.

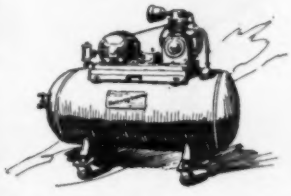
Treat Bearings Right!
They're in the Fight!

ARE PARTS A PROBLEM?

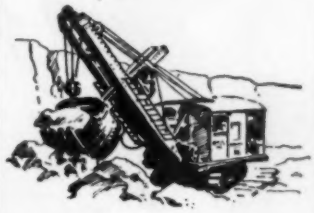
Consider BRAKE SHOE *as a Source*



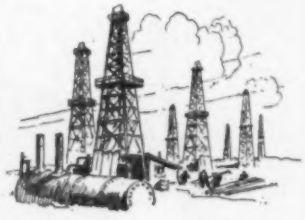
Parts for Trains



Equipment for Garages



Parts for Excavating



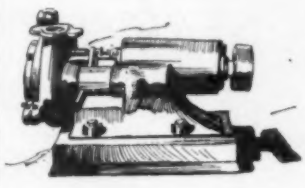
Parts for Oil Drilling

Parts for Planes

Parts in metals, metal alloys and composition.

Parts that are cast, upset, drop forged and molded.

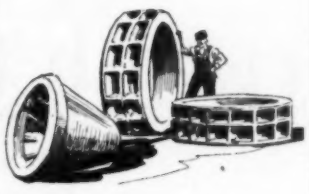
Parts for Cars, Trucks



Industrial Pumps

Parts for Heat Treating

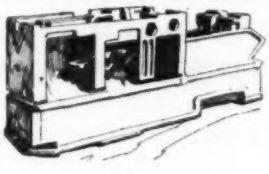
Parts for Ships



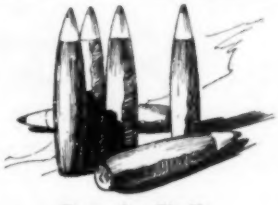
Parts for Crushers

To a manufacturer there just isn't any such thing as an unimportant part, for a piece of equipment is only as good as its weakest part. Knowing this, BRAKE SHOE *engineers* the parts it makes for its customers.

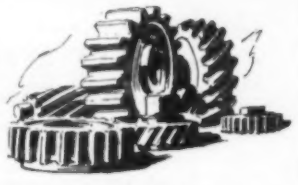
What would closer tolerances in the parts you buy mean in your machine shop costs?



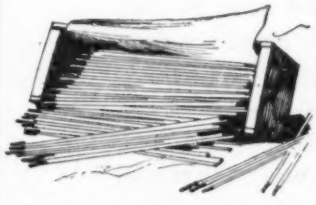
Parts for Machinery



Parts for Shells



Parts for Manufacturers



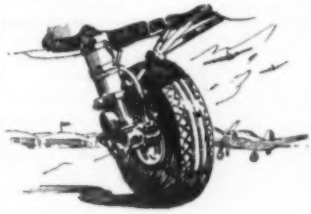
Products for Welding

AMERICAN BRAKE SHOE COMPANY, 230 PARK AVE., NEW YORK 17, N. Y.

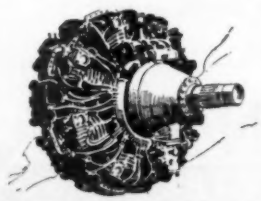
AMERICAN **Brake Shoe** COMPANY

58 PLANTS SERVING INDUSTRY AND TRANSPORTATION

American Brakeblok Division	Detroit, Mich.
Ramapo Ajax Division	New York, N. Y.
American Manganese Steel Division	Chicago Heights, Ill.
Brake Shoe & Castings Division	New York, N. Y.
Kellogg Division	Rochester, N. Y.
American Forge Division	Chicago, Ill.
Southern Wheel Division	New York, N. Y.
National Bearing Metals Corp.	St. Louis, Mo.



Parts for Landing Gears



Parts for Aircraft Engines

Parts for Tanks

Start with the BEARINGS

SLEEVE TYPE BEARINGS

Cast Bronze Bearings
Cast Bronze Graphited
Sheet Bronze Bearings
Sheet Bronze Graphited
Bronze and Babbitt Bearings
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Steel and Bronze Bearings
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Self-Lubricating Bearings
Electric Motor Bearings
Automotive Bearings
Bronze Bars
Bronze Castings

Any Type
Any Size
Any Quantity

● Practically every day we read that a new record of performance has been established. One day it's a plane . . . setting a new mark for speed . . . or altitude . . . or distance. The next day it's a machine tool . . . providing longer hours of operation . . . with greater loads and speeds. These records are possible only when the motive unit operates with the highest degree of efficiency.

Before any motive unit can operate efficiently it must be equipped with the *correct* type of bearing for each application. That's where we come in. For more than thirty-five years we have helped manufacturers of all types of equipment select the bearing that will deliver the greatest performance.

At the present, all of our manufacturing facilities are engaged in the production of sleeve bearings for armament. But our advice and counsel is available. Simply write us and a Johnson sales engineer will call on you . . . at your convenience.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD
515 S. MILL STREET NEW CASTLE, PA.

Telephone your ISD FIRST

What would *you* do, if you found at 4 p.m. that your assembly line was running out of critical parts—with the manufacturer 500 miles away?

Right! You would telephone your ISD Industrial Supply Distributor *first.* And it's a fair break that he might be able to deliver from stock—or could "beg, borrow or steal" enough to keep you going until his next shipment came in.

It's a vital part of your Industrial Supply Distributor's business to know what materials you must have to keep your operations on schedule. He orders ahead for you and all his other customers. He buys on priority—he buys as much as he can—he buys as often as he can.

Why not simplify *your* purchasing in these short-handed times? Order from your Industrial Supply Distributor—check with him ahead of your needs. The chances are he will say in effect:—"sure—that stuff is coming through from the factory by truck—*tonight!*"

ARMY NAVY ARMY E NAVY

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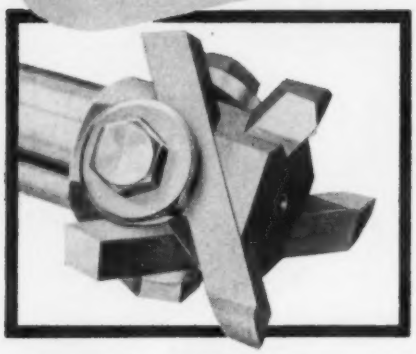
"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

a totally different kind of surface facer



IMPOSSIBLE? *You bet not!*

Every claim made for this tool *can be proved!*

1. Replaces End, Shell, Slab Mills, and Inserted Tooth Cutters;
2. Fits all vertical and horizontal milling machines, drill presses and other spindle machines;
3. Quickly and accurately adjustable, just four tool sizes cover all fractional diameters from 1¼" to 5";
4. Slashes tool costs up to 75 per cent;
5. Clark tool blades are not ruined by hard spots in castings, re-extruded Dural, etc.—bits may be quickly touched up and sharpened free hand;
6. Tool blade life is unusually long, replacement cost low;
7. Cuts any material under the most severe operating conditions accurately, swiftly, economically;
8. Ample blade clearance avoids chip clogging and resultant slow-downs;
9. Tools available with all types of blades, including carbide tips;
10. Prompt delivery on suitable priority.

CALL YOUR JOBBER TODAY
WRITE FOR BULLETIN NO. A M S

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FACING TOOL

GET THE FACTS
about **Clark Adjustable Hole & Fly Cutters**—they, too, are remarkable new-type tools!

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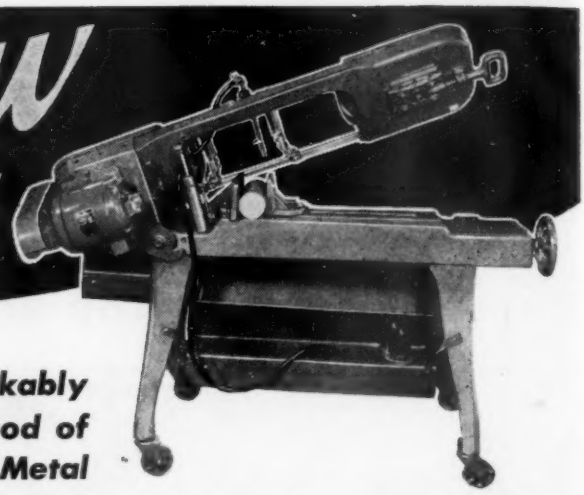
Manufacturers: Precision Tools, Precision Parts

New Coolant Model



A Remarkably Fast Method of Cutting Off Metal

KALAMAZOO Metal Cutting Band Saw

Amazing speed for continuous production on cut-off work. Faster—as Band Saw cutting has no heat generation—no drag or inertia to overcome—and practically no speed limitations.

Smooth—accurate—quick, easy set-up—moderate cost. Pays for itself on savings in time—labor—depreciation—power and tool steel.

Large enough for 95 per cent of all cut-off work. Cuts any size or shape up to capacity of throat. Two sizes (9"x16"), (8"x24")—four speeds—portable—plugs in anywhere.

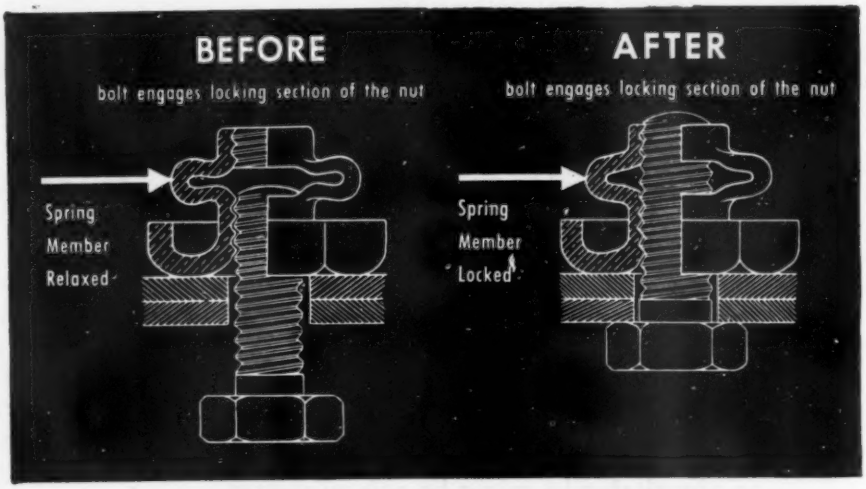
Making big savings for thousands of progressive plants.

STANDARD MODEL FOR INTERMITTENT SERVICE. (Coolant can be added at any time).

COOLANT MODEL FOR PRODUCTION CUTTING. (Triples the speed of Standard Model with increased life for saw blades).

Detailed bulletin on request.

MACHINE TOOL DIVISION • KALAMAZOO TANK & SILO CO
KALAMAZOO, MICHIGAN



VIBRATION-PROOF NUTS

One-piece, all-metal construction gives Boots Self-Locking Nuts these distinct advantages over all other nuts: greater re-usability in maintenance; proof against corrosive action of oil, water and chemicals; resistance to high temperatures. Boots Nuts meet all specifications of government aviation agencies in an industry where loose fastenings will not be tolerated.

There's a BOOTS NUT for every application

ROL-TOP **BOOTS** ANCHOR

BOOTS AIRCRAFT NUT CORPORATION
GENERAL OFFICES, NEW CANAAN, CONNECTICUT

IT'S

GRAFCO

HYDRAULIC TUBE COUPLINGS

On America's planes, ships, tanks, and other war equipment . . . in the machine tool field and in industry generally . . . Grafco Hydraulic Tube Couplings are performing dependably.

Where we started.

V. L. GRAF COMPANY

Engineers and Manufacturers of

GRAFCO HYDRAULIC EQUIPMENT

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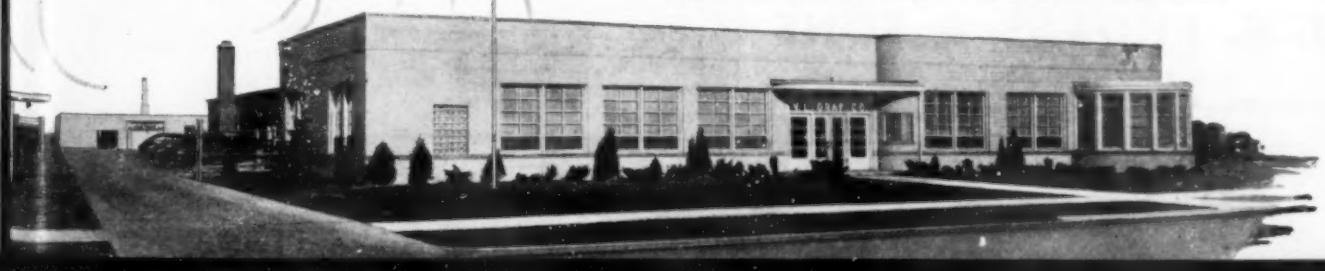
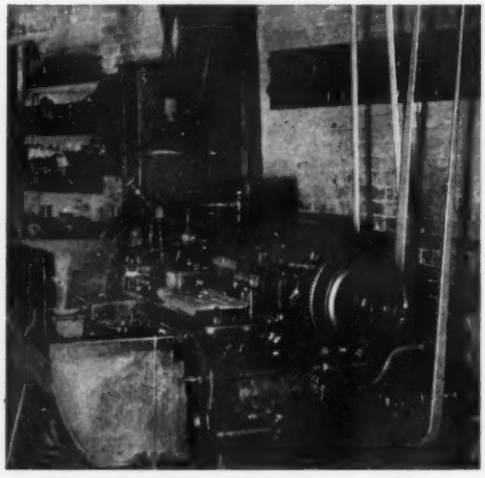


Tannate

BELTING GIVES YOU MORE PRODUCTION WITH PRESENT MACHINES



On thousands of important jobs TANNATE leather belting is helping to increase production. The unusual strength of Tannate and its firm pulley grip keep machines running smoothly at full capacity, even under varying load conditions. It resists heat, oil, moisture and many weak chemicals better than oak tanned leather. And, Tannate has plenty of endurance for 3-shift, 7-day-a-week operation — with little maintenance other than an occasional treatment with Rhoads Belt Preserver.

Let Tannate help you keep all your machines running at full capacity! It will increase your output and reduce production costs!

Write for our free Belt Length Calculator; it figures belt length quickly and accurately.

STEP UP PRODUCTION with

RHOADS Tannate WATERSHED LEATHER BELTING

—Established 1702—

J. E. RHOADS & SONS

35 N. SIXTH ST., PHILADELPHIA, 6, PA.

NEW YORK • CHICAGO • ATLANTA • CLEVELAND

ready for your use!

(Just out)

DIE ENGINEERING LAYOUTS and FORMULAS

that are proving their value right now in toolrooms throughout the country

. . . **A new guide** presenting drawings and photographs with detailed explanations of 90 per cent of all the key designs used in tools for presswork.

. . . **Hundreds of sketches,** complete drawings and photographs made by recognized leaders in the field show the work—the die—the method of manufacture.

. . . **Clearly presented** mathematical formulas, necessary for the successful engineering of a die sequence come to you in practical, usable form.

DIE ENGINEERING LAYOUTS and FORMULAS

By C. W. HINMAN

Former Chief of Jig and Fixture Design, Western Electric Co., Chicago; former Chief Tool Engineer, Automatic Electric Company, Chicago.

497 pages, 6 x 9, 366 illustrations, $5.00

A PRACTICAL toolroom engineer brings you in this new book the gist of his 40 years' experience in interchangeable manufacture. Here are drawings and photographs with detailed explanatory text of 90 percent of all the key designs used in tools for presswork. The book includes all the necessary mathematical formulas for laying out the assembled dies in a clearly rendered drafting technique—shows dies for producing war equipment that reveal basic principles of many key designs that will have wide application in fabricating an endless variety of small precision parts after the war—shows you the drafting short-cuts that war production has worked out. Nearly all the tool designs are complete working drawings from which many of the tools described, or similar ones, could be built from the dimensions given.

Some special features:—

- die designs that require minimum use of critical materials
- variety of layouts for scrap-strip designs
- explanation of how to make die drawings by a short method especially adapted to drafting assembly dies
- methods for designing and drafting progressive dies widely used in blanking and forming parts for small guns and fabricating endless variety of small precision parts
- section of method of manufacturing small calibre shells, also of drawing large cartridge cases
- etc., etc.

Those who are familiar with HINMAN'S

PRACTICAL DESIGNS FOR DRILLING AND MILLING TOOLS

and

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Company ..... A. 8-5-43

THEY'RE THE NUTS FOR POSTWAR PLANNING

IT's true that now we can't supply all the Elastic Stop Nuts Uncle Sam wants – even with three big plants running 24 hours a day.

It's true that Elastic Stop Nuts are flying in every American plane – sometimes 50,000 of them in a single ship.

It's true they're on tanks, guns, naval vessels and production equipment–more than all other lock nuts combined.

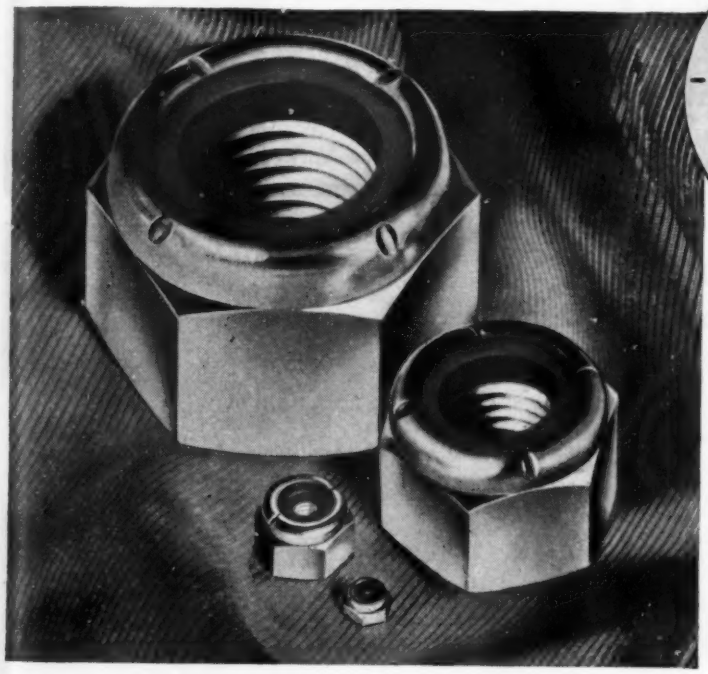
This is because these nuts stay put. There's a red elastic locking ring in the top which grips the bolt with an oil- and water-proof seal and eliminates all axial play and wobbling.

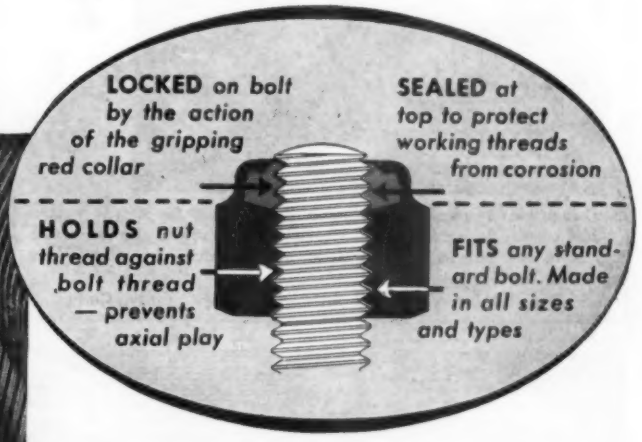
When the war's won, the millions of Elastic Stop Nuts we're pouring out each day can be turned to the fastening problems of peace.

They can be turned to producing better products and equipment that will save time and expense for maintenance engineers.

Whatever your fastening problems might be, our engineers, experienced in the work of both war and peace, will be glad to help cope with them.

Feel free to call upon them. They'll work with you and suggest the proper Elastic Stop Nut to lick the job.




LOCKED on bolt by the action of the gripping red collar
SEALED at top to protect working threads from corrosion
HOLDS nut thread against bolt thread — prevents axial play
FITS any standard bolt. Made in all sizes and types

ELASTIC STOP NUTS

Lock fast to make things last

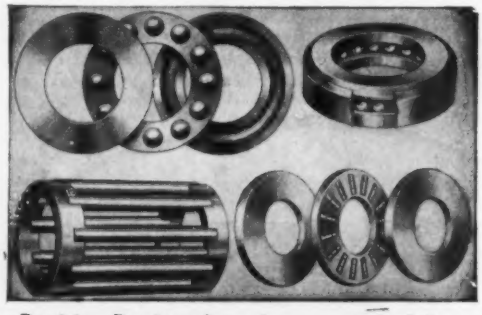
ESNA TRADE MARK

ELASTIC STOP NUT CORPORATION OF AMERICA
Union, New Jersey and Lincoln, Nebraska

In tests of arms, explosive shocks make war on hollow screws. Giant stresses attack the holding-power of fastenings. Behind battle fronts the machinery of production strains and batters away at restraining *threads.*

But for 30 years before this war, "ALLENS" met tests no less critical at the time. Each new demand for holding power brought new ALLEN developments *in advance.* We proffer you now — Dependability *IN ADVANCE.*

The Allen Mfg. Company ★ ALLEN ★ Hartford, Conn., U. S. A.



B & R B

Precision Bearings have been recognized for many years for their dependability. These bearings can be selected from our catalog of standard sizes which are carried in stock.

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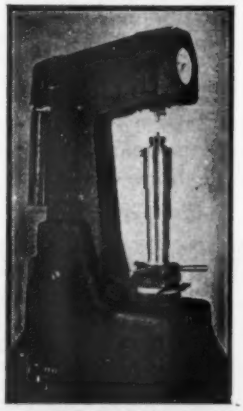
HARDNESS TESTER

BETTER and BETTER
EACH YEAR
SINCE 1921



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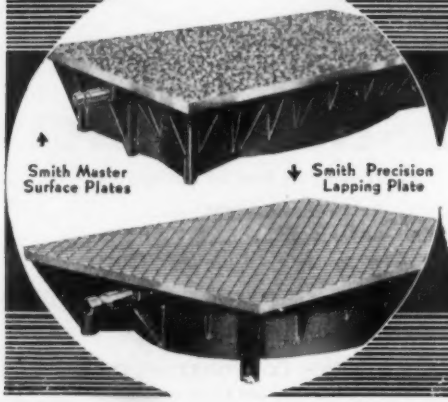

ENGINEERED for *Precision* Usage

Smith Master Surface and Lapping Plates have become the standard for precision accuracy in aircraft and ordnance plants all over the country. Gauge makers who demand a superior surface plate and precision accuracy are standardizing on Smiths.

For sizes, prices, and delivery, wire, phone or write.

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Elliptical rib construction exclusive with Smith

STREAM-LINED
as a fighter plane

HOLDS FIRM
as the Marines on Guadalcanal

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as a Yankee sharpshooter

EFFICIENT
as America's production lines

IT HELPS WIN THE BATTLE OF PRODUCTION

Thompson SPRING COLLET Adapter

Designed in two simple parts, Thompson Spring Collet Adapter is quick and easy to apply . . . eliminates awkward, bulky chucks . . . gets closer to the work, yet allows free access.

A better adapter means faster, better work. The Thompson trade-mark means a better adapter!

Write for literature and prices

Special wrench supplied with each adapter. Standard spring collets available on order.

Army-Navy "E" awarded to Auto-Ordnance Corporation for excellence in production of "Tommy" Guns

AUTO-ORDNANCE Corporation

THOMPSON TOOL DIVISION

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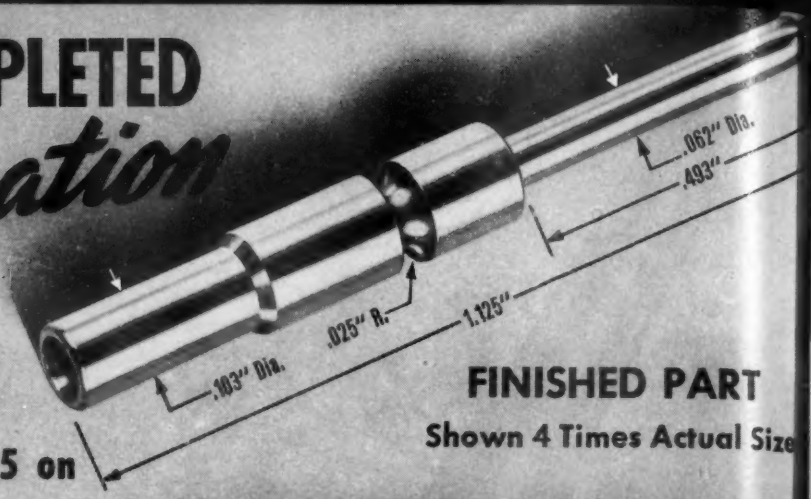
THIS PART COMPLETED *in One Operation*

IN LESS THAN 9 SECONDS

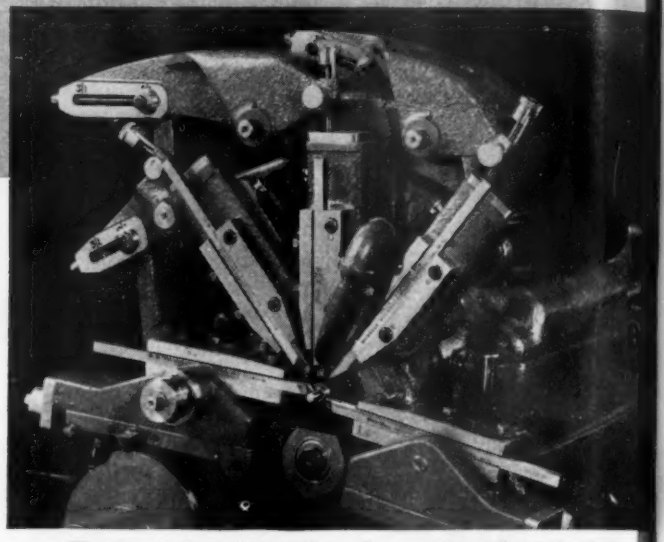


FINISHED PART
Shown 4 Times Actual Size

Tolerances Held Within ± .0005 on GORTON 16-A *Precision* AUTOMATIC

The accurate, high speed production of this precision part is simple and highly efficient on the Gorton 16-A. Only this tooling is required: 6 cams, 5 cutting tools, one drill, 2 collets and one bushing. Drilling of hole is accomplished with attachment mounted ahead of cutting tools.

Tolerances on all dimensions are held within ±.0005"; extremely high finish is maintained. Seven pieces are produced per minute with spindle speed of 8700 r.p.m. and surface speed of 290 f.p.m. Material is ⅛" round free-cutting brass.



The 5 actual cutting tools used to produce this job, shown in position on the Gorton 16-A 5-Station Multiple Tool Head.

IN *1* OPERATION
TURNS, CENTERS, DRILLS, THREADS, SLOTS

The Gorton 16-A mass-produces an almost endless variety of short or long slender parts—simple or complex—complete in *one* operation. It does step and contour turning and chamfering in multiple diameters—tapers, knurls, bevels, back recesses, pivot points, etc.

Extreme accuracy and unusually high finish are maintained; second operations often eliminated. Maximum accessibility of all vital parts and controls insures simplicity of set-ups and operation.

George Gorton Machine Co.
1315 Racine Street, Racine, Wisconsin, U.S.A.

WIDE RANGE OF WORK
SMALLEST .005" dia. by 1/32" long
LARGEST 7/16" dia. by 2¾" long

OUR GOLDEN ANNIVERSARY 1893-1943

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Send me, without obligation, FREE bulletin with complete information covering the Gorton 16-A Precision Automatic Screw Machine.

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50 YEARS OF PRECISION TOOLS

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SPECIALISTS FOR 50 YEARS IN REPRODUCING FROM MASTERS—ENGRAVING, DIE MAKING, VERTICAL MILLING MACHINES

She filled this order in three minutes

AND THREE MINUTES is no record—just average for this Ozalid Whiteprint Machine. But no other printmaking process could fill the order in *any* length of time.

Ozalid has eliminated the chemical baths and driers which cause distortion. You're able to use a wide variety of sensitized materials . . . and produce prints in one continuous operation which incorporates Exposure and Dry Development.

Check These Printmaking Extras:

1. You can make prints having blue, black, or maroon lines on a white background. You can assign a special color to different departments; immediately distinguish checked from unchecked prints, etc.

2. You make "duplicate originals" in the same manner as standard prints—without Van Dyke tieups. These may be substituted for the original in subsequent print production . . . or they may be used by the draftsman to eliminate retracing when making design changes.

3. You can print separate details on different foils . . . and combine these, if you wish, to make composite prints. Foils may also be used to reclaim soiled originals.

All Ozalid materials are available in cut sheets as well as roll stock—thus trimming waste can be eliminated.

Full Line of Machines

There's an Ozalid machine for every print production requirement. So, if you want to turn out prints at speeds up to 20 feet per minute—or if you only need a dry developing unit to use with your present printer—adopt Ozalid.

Write for Catalog and sample booklet of Whiteprints. See how leading manufacturers save time, labor, and materials.

Ozalid—More Than A Printmaking Process

OZALID PRODUCTS DIVISION

GENERAL ANILINE AND FILM CORPORATION

Johnson City, N. Y.

OZALID IN CANADA—HUGHES OWENS CO., LTD., MONTREAL

AROUND THE WORLD
...THEN BACK TO YOU

When peace comes . . . — Aeroquip, war-tested in aircraft operations from the Arctic to the Sahara to the Solomons, will return from war work and open new horizons for industrial and chemical uses of liquid-carrying lines. Plan ahead — write now.

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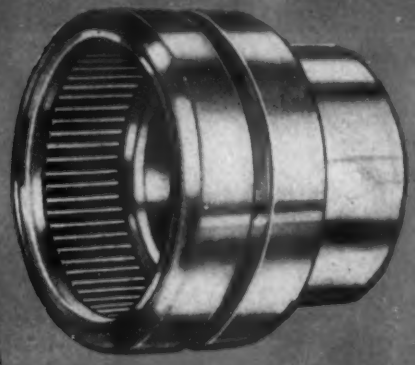
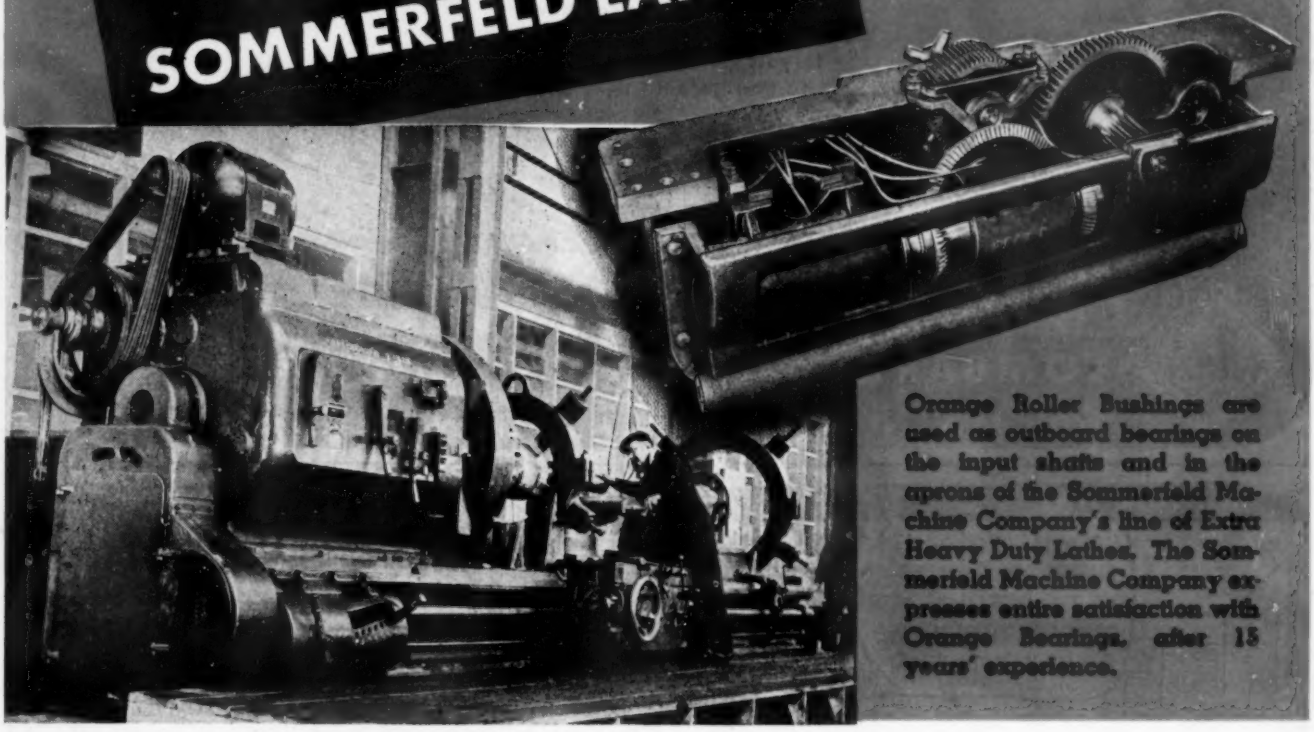
ORANGE ROLLER BUSHINGS "Take the Load" for SOMMERFELD LATHES





Orange Roller Bushings are used as outboard bearings on the input shafts and in the aprons of the Sommerfeld Machine Company's line of Extra Heavy Duty Lathes. The Sommerfeld Machine Company expresses entire satisfaction with Orange Bearings, after 15 years' experience.

Orange Roller Bushings are "taking the load" in many difficult applications on equipment of all kinds. Which is not surprising, because one of the outstanding characteristics of Orange Roller Bushings is high load carrying capacity in small space.

To this ruggedness, Orange Roller Bushings add exceptionally even, quiet, long-life operation — result of rigid standardization of size. Roller clearances are held to a minimum, therefore running clearances are closer, preventing rollers from running tangent to race.

Orange Roller Bushings are made in a full range of types and sizes to meet practically all requirements. Consult our engineers on any bearing application. Send for Engineering Data Book showing sizes and types of Orange Roller Bushings.

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Orange Roller Bearing Co., Inc.,
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Please send me your Roller Bushing Data Book

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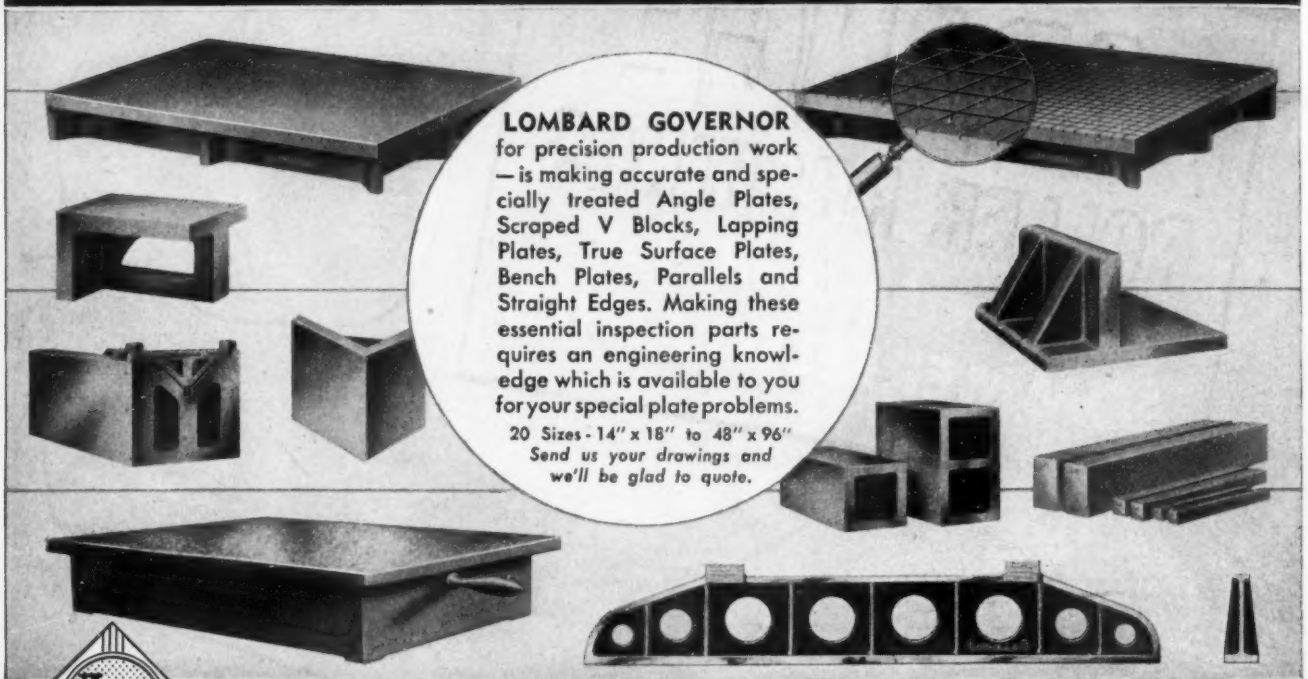

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for precision production work — is making accurate and specially treated Angle Plates, Scraped V Blocks, Lapping Plates, True Surface Plates, Bench Plates, Parallels and Straight Edges. Making these essential inspection parts requires an engineering knowledge which is available to you for your special plate problems.

20 Sizes - 14" x 18" to 48" x 96"
Send us your drawings and we'll be glad to quote.

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500 MAIN ST., ASHLAND, MASS., U. S. A.

OUT OUR WAY BY J. R. WILLIAMS

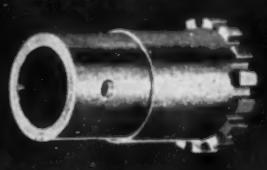
BOY, IS THE OL' BULL BURNED UP! HAVIN' TO USE THE WORKMAN'S WASH ROOM AN' STANDIN' IN LINE FOR HIS TURN TO BOOT!
YEH— DEMOCRACY'S SURE WORKIN' 'ROUND HERE SINCE ALL THEM DAMES MOVED IN AN' THE OL' BULL HAD TO GIVE UP HIS OWN PRIVATE WASH ROOM TO THEM!
COPR. 1941 BY NEA SERVICE, INC. T. M. REG. U. S. PAT. OFF.
J.R.WILLIAMS

Don't sell the 'Old Bull' short...

He and the thousands of other "Old Bulls" are doing a gigantic job these days, keeping our boys on the firing lines supplied with the weapons and tools to win this war and the men on the production line with inspiration and understanding. To them and their men is due great credit for the strides industry has made in developing new techniques as they produced for Victory. Things like the ability to put *precision parts* on a low cost mass production basis, which has greatly speeded our war effort and which will be so important in peacetime. For it means that after Victory finer, better made products can be mass produced... will be available to everyone. It means jobs, too, when the boys come marching home.

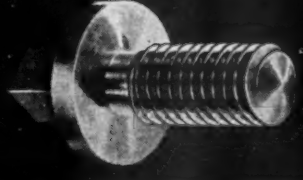
(Below) A few of the many thousands of our precision-made parts that help "Keep 'em flying and fighting."

ERICSSON ESTABLISHED 1911



ERICSSON

SCREW MACHINE PRODUCTS CO., INC.
25 LAFAYETTE STREET, BROOKLYN, N. Y.



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Think of being able to find the answer the *right* answer—to any question—quickly—layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances—any detail of machine shop or drafting room practice. In one book that will fit into your pocket this Handbook fills all practical reference needs. The Handbook enables you to go ahead at any time, knowing that you are right, with the wealth of expert evidence in the handbook behind you—a service worth many times the cost of the Handbook in time, trouble, and wastage saved.

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How to give a SOCKET SCREW the old "one-two"

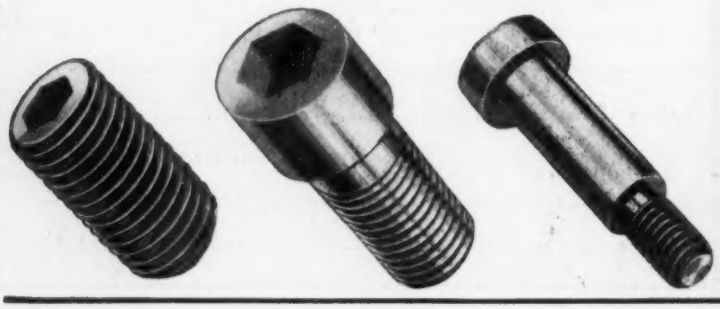
Steel-fisted slugger makes sure Parker-Kalon Socket Screws can take bigger shock loads than they'll ever meet . . . . .

There's no b'guess and b'gosh about the shock load resistance of Parker-Kalon Socket Screws. The Olsen Universal Impact Tester in Parker-Kalon's Quality-Control Laboratory can deliver a "haymaker" equal in force to a one-pound weight dropped 264 feet, creating tension, shear, and bending stresses far above normal. Only screws that have stamina to spare can survive this rigorous test.

Measuring shock load resistance is only one of the 16 tests and inspections that are made to assure the *dependable* performance of P-K Cold-forged Socket Screws. This rigid routine of quality control eliminates the "doubtful screws" – screws that *look* all right, but some of which fail to *work* right. Socket Screw users need this protection today more than ever. Specify "Parker-Kalon" next time you order . . . it costs no more. Parker-Kalon Corp., 194-196 Varick St., New York, N. Y.

This 16-point "Quality-Control" protects P-K Socket Screw Users

1–Chemical Analysis. 2–Tensile Strength. 3–Ductility. 4–Torsional Strength. 5–Ability to take Shock Loads under Tension. 6–Resistance to Shock Loads under Shear. 7–Hardness. In addition, there is a rigid inspection of these essentials: 8–Head Diameter. 9–Head Height. 10–Concentricity of Head to Body. 11–Socket Shape. 12–Socket Size. 13–Socket Depth. 14–Centricality of Socket. 15–Class 3 Fit Threads. 16–Clean Starting Threads.



PARKER-KALON
Quality-Controlled
SOCKET SCREWS

WORLD'S LARGEST HONING TOOL

machined by Defiance!

● Here's the largest honing tool ever made (41½" diameter) ... being accurately machined on a Defiance Boring Mill at the Micromatic Hone Company, Detroit.

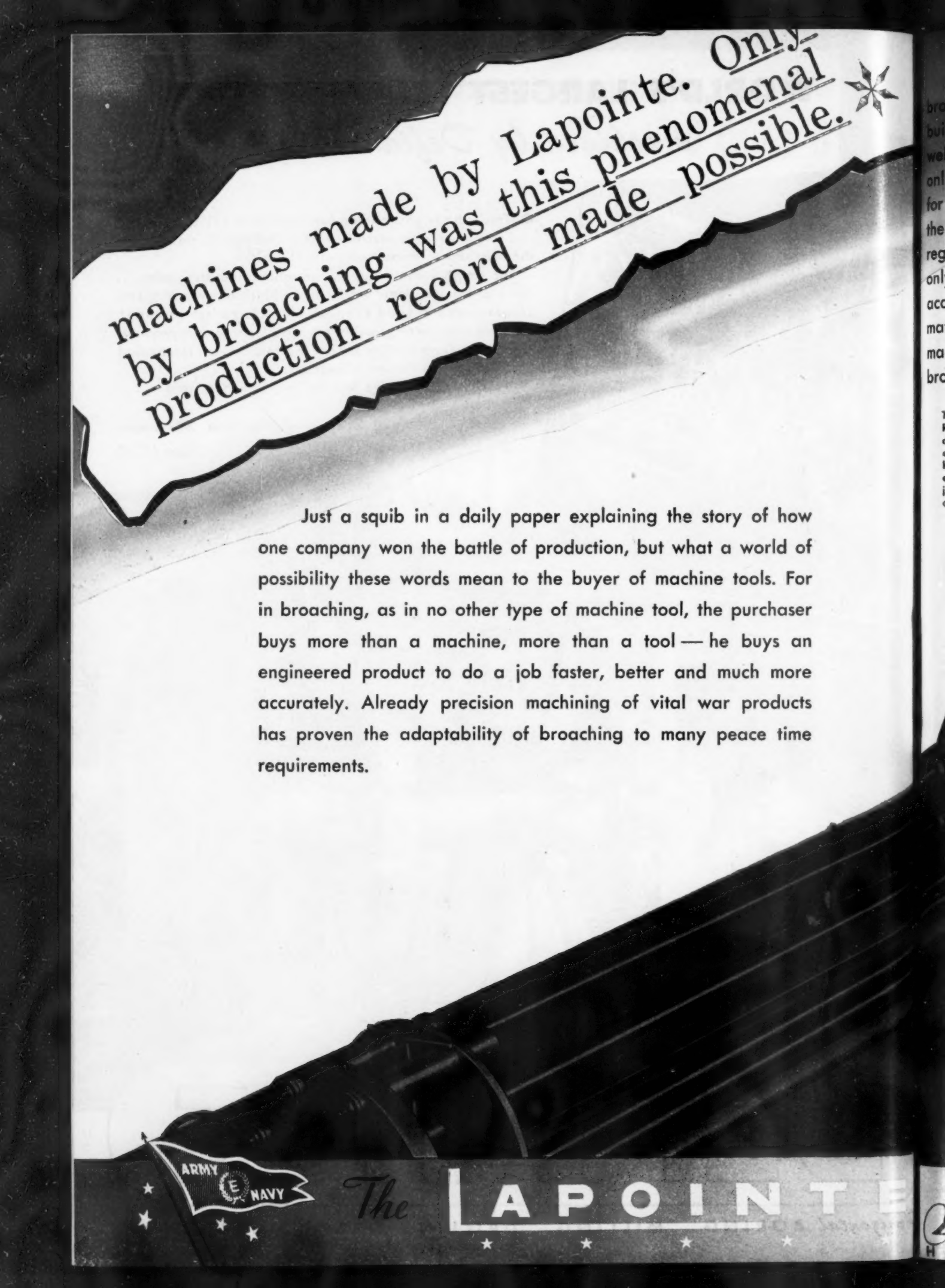
For tough jobs like this throughout industry today... more and more plants use Defiance Machines where speed, accuracy and rugged simplicity of design are essential. Defiance Engineering builds 'em *right* with utmost *precision, ruggedness, dependability!* See our insert in Sweet's Mechanical Catalog or write for latest bulletins.

Defiance Machine Works, Inc., Defiance, Ohio

Makers of Precision Machinery Since 1850

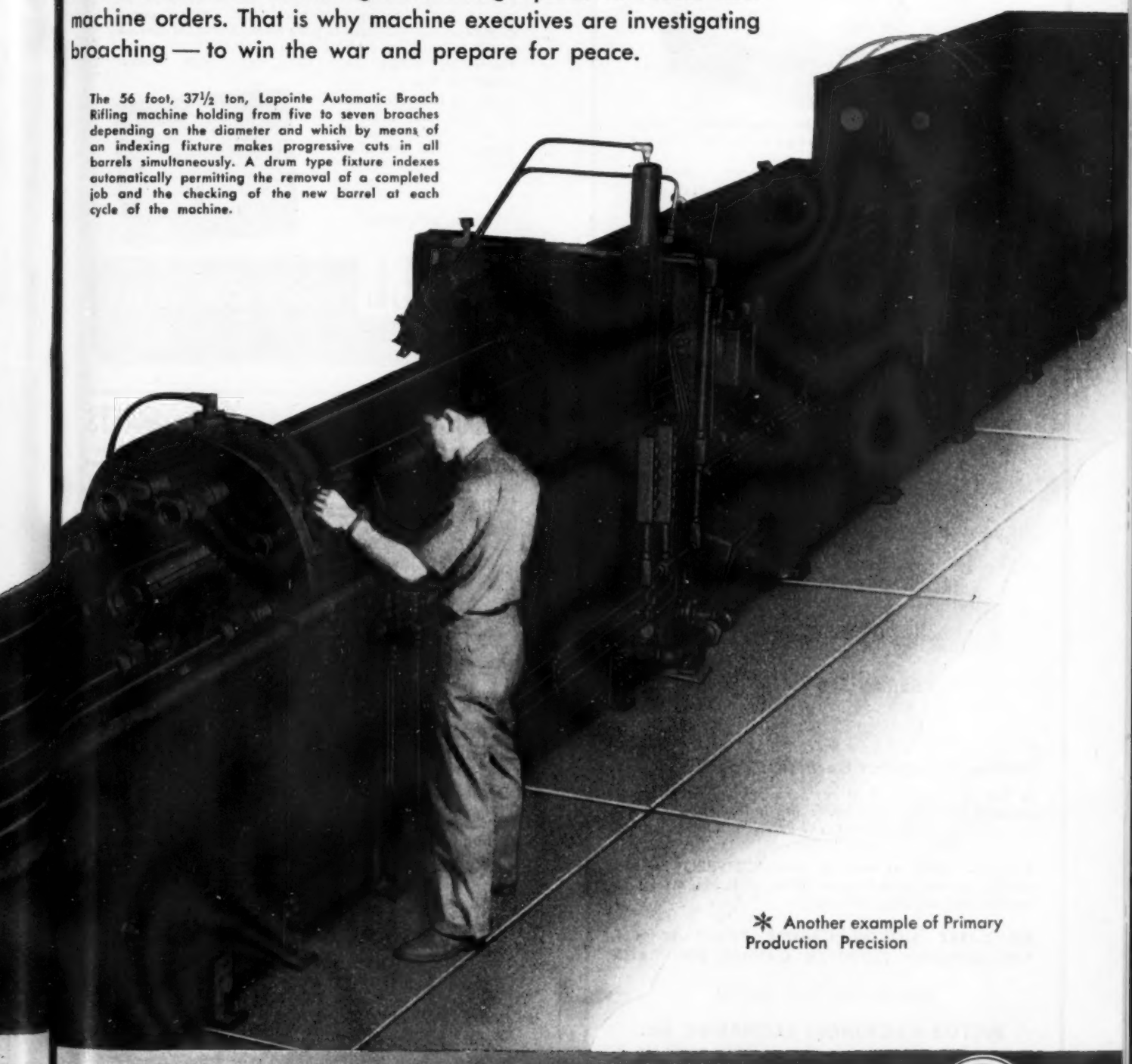
DEFIANCE

Horizontal BORING . . MILLING . . DRILLING . . TAPPING *Machines*


machines made by Lapointe. Only
by broaching was this phenomenal
production record made possible.
Just a squib in a daily paper explaining the story of how one company won the battle of production, but what a world of possibility these words mean to the buyer of machine tools. For in broaching, as in no other type of machine tool, the purchaser buys more than a machine, more than a tool — he buys an engineered product to do a job faster, better and much more accurately. Already precision machining of vital war products has proven the adaptability of broaching to many peace time requirements.
ARMY E NAVY
The LAPOINTE

Economics of Broaching. Broaching machines or broaches cost money — a lot of money, but into each machine is built the engineering knowledge to do a particular type of job well. Each broach and machine is designed to do its job right. Not only in its mass production but in its accuracy, does broaching pay for itself. For it is this vital exactitude which makes the first and the thousandth part perfect twins, that has won broaching the high regard it now holds in the machining field. Broaching is economical only when it can do its particular job faster and quicker, more accurate and less expensive. That is why the new Lapointe automatic versatiles are winning such a high place in recent new machine orders. That is why machine executives are investigating broaching — to win the war and prepare for peace.

The 56 foot, 37½ ton, Lapointe Automatic Broach Rifling machine holding from five to seven broaches depending on the diameter and which by means of an indexing fixture makes progressive cuts in all barrels simultaneously. A drum type fixture indexes automatically permitting the removal of a completed job and the checking of the new barrel at each cycle of the machine.



* Another example of Primary Production Precision

Machine Tool Company ★ ★

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TUNGSTEN
CARBIDE TIPPED TOOLS
Price $1.00 Each In Any Size

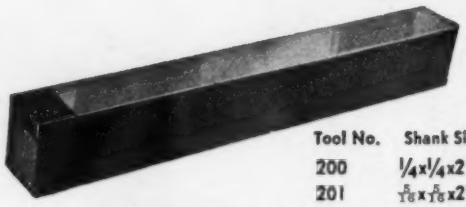
New Low Prices—Increase Production—
Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

Left Hand-Reverse Image. Right Hand Shown

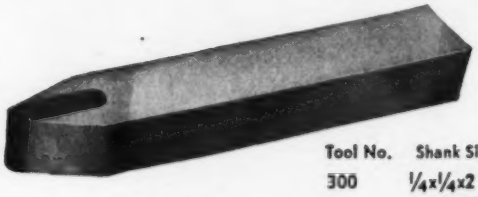
SERIES 100

Tool No. RH	LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2



SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

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251 CENTER STREET NEW YORK, N. Y.

TUTHILL MODEL M

THE COOLANT PUMP THAT TAMES CHIPS AND GRIT

Small chips and grit hold no terror for this positive-displacement, internal-gear rotary pump. Through its built-in, automatic by-pass, the Tuthill Coolant pump permits foreign particles to pass through without serious injury to working parts, also compensating for wear. This safety feature assures long, dependable, uninterrupted service.

Model M is available in six sizes from 1 to 50 g.p.m. Also furnished in stripped form for direct incorporation into the design of the machine to save space and material.

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Tuthill Pumps are serving Army • Navy Air Force Merchant Marine

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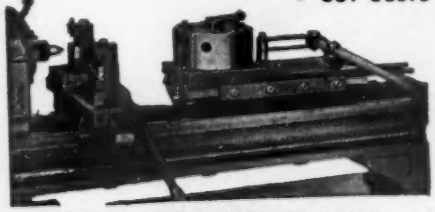
HEAVY DUTY Self-Indexing BED TURRETS

SAVE TIME • SPEED PRODUCTION • CUT COSTS



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Complete unit with cut-off cross slide and tool posts designed for Logan, South Bend, Atlas and similar types of bench lathes.

Has 6" head and 5½" turret travel. For lathes up to 14" swing.

Bed turrets with pilot wheel for large lathes built to order. Let us know your needs.

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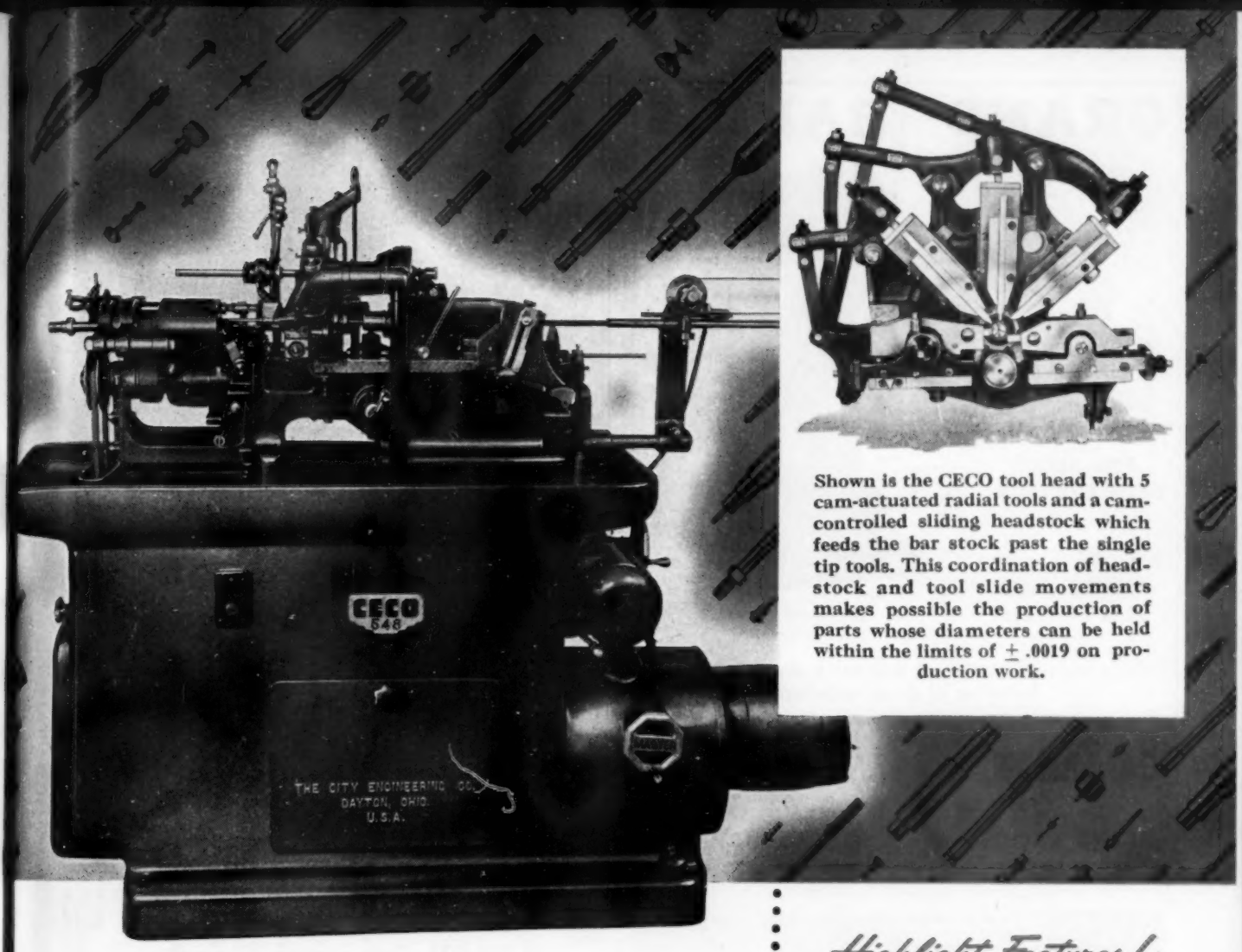

Shown is the CECO tool head with 5 cam-actuated radial tools and a cam-controlled sliding headstock which feeds the bar stock past the single tip tools. This coordination of headstock and tool slide movements makes possible the production of parts whose diameters can be held within the limits of ± .0019 on production work.

Ceco gives One-Operation

PRECISION PRODUCTION

of Intricate Parts with Single Tip Tools

CECO REVOLUTIONIZES THE MASS PRODUCTION OF EXTREMELY ACCURATE HIGH FINISH PARTS

America's bellwether makers of precision instruments have found that the CECO Automatic Screw Machine gives them economy, accuracy and high finish precision production of intricate parts, such as those shown on this page, undreamed of with conventional screw machines.

DIESEL SUBMARINE ENGINE PART CECO-MADE IN ONE OPERATION

This part was generated in one operation to extremely high finish without grinding, using single tip tool, which leaves no tool or chatter marks as with formed tools.

MATERIAL: Tough alloy steel.

DIAMETER: Extremely close tolerance.

Highlight Features!

BAR CAPACITY: Available in ⅜" and ½" bar capacity.

4 or 5 RADIAL TOOL SLIDES.

MAXIMUM TURNING LENGTH: 4" with flat cam.

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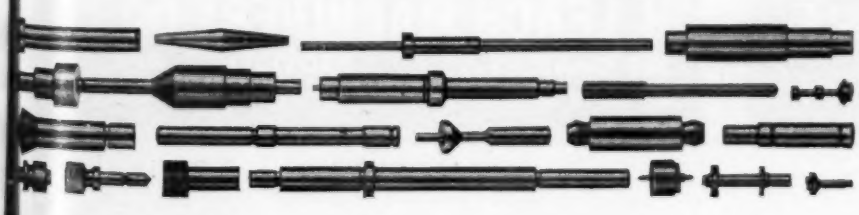

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UNIVERSAL PRECISION SCREW MACHINES

THREE MODELS:—4-3-8, 5-3-8, 5-4-8

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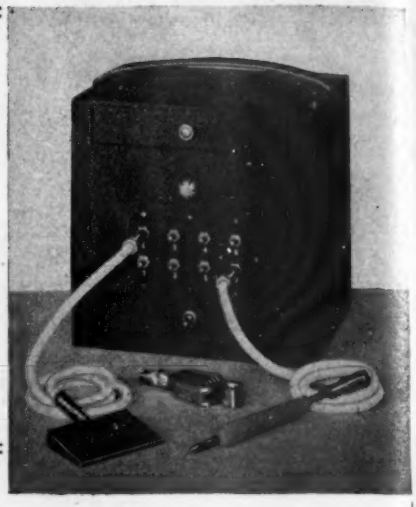

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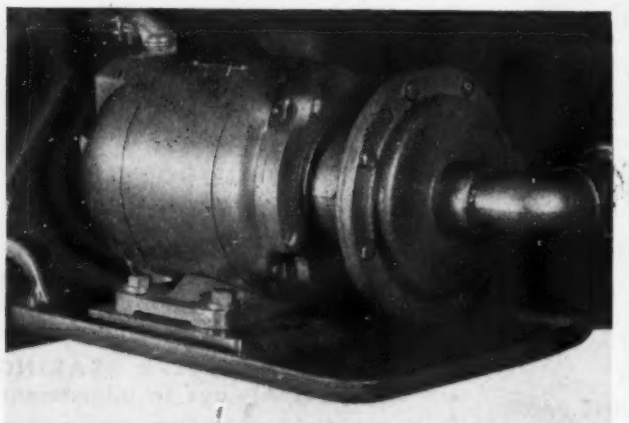

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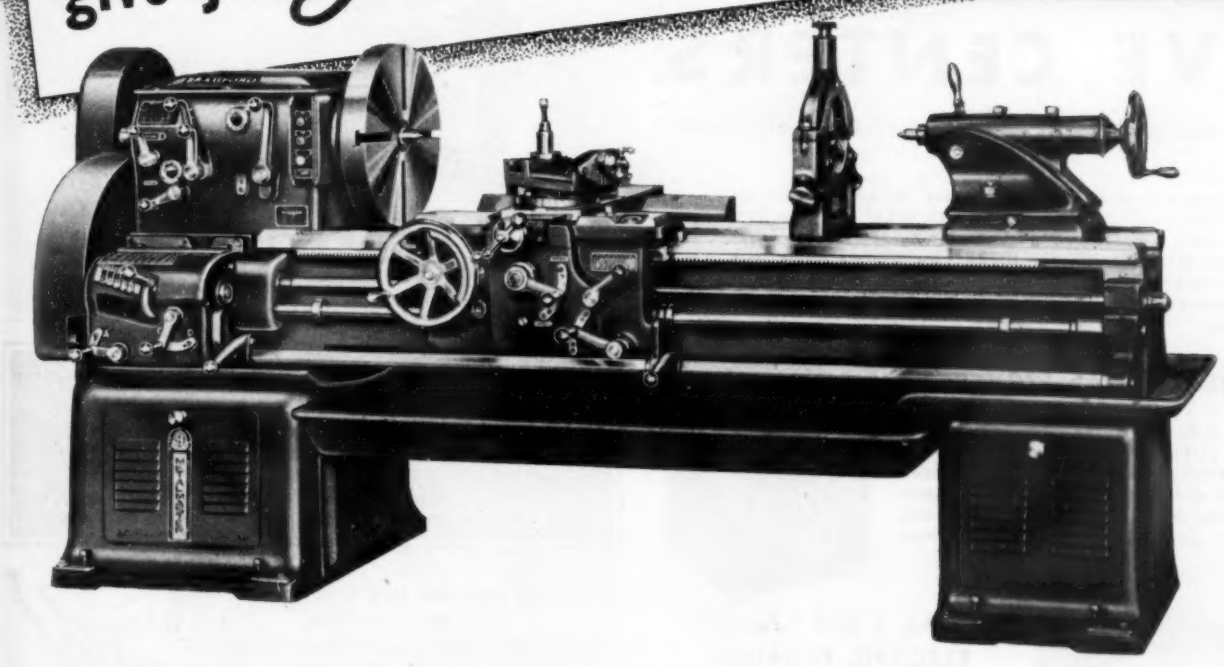

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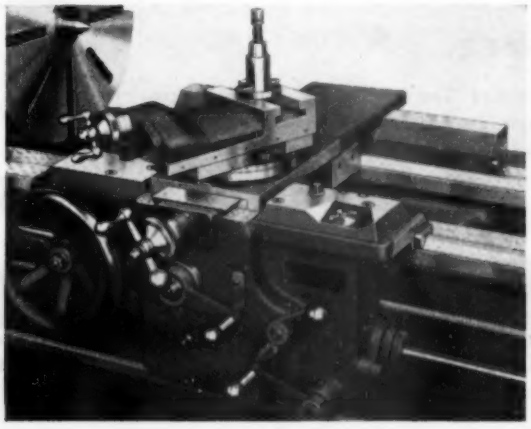

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MANUFACTURERS OF METAL WORKING LATHES; CAM FEED DRILLING AND TAPPING EQUIPMENT, HYDRAULIC DRILLING MACHINES . . . IN BUSINESS SINCE 1840

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Also, Lead Hammers sizes 1 to 15 lbs. always in stock.

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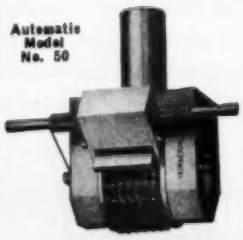
For stamping into metal, etc.

Automatic Model No. 50



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Modern warfare has created demands for new types of fighting equipment—which, in turn, requires new kinds of production tools. Disston, with more than a century of experience in fine toolmaking, is helping to solve many of these wartime problems.

One such important job was the manufacture of a special file—for work on a troublesome piece of Army Ordnance. The specifications were most stringent. The double bevel on the edge of the tool had to be cut with a file surface of 98 teeth to the inch, and the edge formed by both bevels had to be held to a perfectly straight line. Furthermore, special dies had to be made to hold the file to the correct radius during the heat treating operation.

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Conserve vital man-minutes in your plant with Disston quality tools—and with *free* Conservation Control instruction cards on tool use and care. For complete information write Henry Disston & Sons, Inc., 820 Tacony, Philadelphia 35, Pa., U. S. A.

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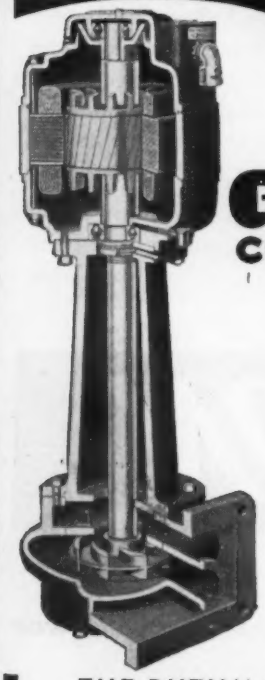

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"UNBRAKO" HOLLOW SET SCREWS WITH THE *KNURLED POINTS* *hold fast* —stay put. Knurls *dig in*, prevent loosening by vibration, yet can be easily removed and used any number of times.

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More than 70 years ago this Elmes 2-plunger, 4"-stroke job was a pumping sensation. Perhaps the first high-pressure pump made in this country, it established a principle of design which has since become the standard. Yet it merely carried on the quality tradition which has distinguished Elmes products for 92 years.

Compare that doughty 1870 Elmes model with an Elmes pump of today—such as the big, roller-bearing masterpiece of streamlined design and heavy-duty efficiency shown above. This 6-plunger, high-pressure unit with its 400 horsepower, was built for a highly specialized operation which called for extraordinary precision both in engineering and construction—and pressures of 35,000 pounds per square inch! It is a good example of the advanced hydraulic equipment that Elmes is supplying to modern American industry.

The ability of Elmes to build better hydraulic equipment springs from a background of continuous, progressive engineering achievement covering nearly a century. Many of the first hydraulic installations used in American industry were designed by Elmes.

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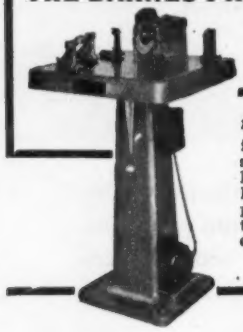
THE BARNES PRECISION CUTTER GRINDER
will accurately grind to any PROFILE you require . . .



for example:
first grinding of formed cutters with assurance of preserving form exactly and lengthening cutter life five to eight times. It will grind gangs of formed cutters—plain, concave, convex or angular—shell tools—shank tools—form turning tools—cutters with undercut and spiral teeth.

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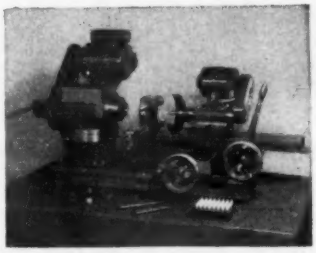
GENERAL MACHINERY CORP.
140 Federal St. Boston, Mass.

ABRASIVE INTERNAL GRINDER



No. IG

Get acquainted with the complete line of Abrasive Grinding Machnies.

Information available in Sweet's Catalog, from nearest dealer or home office.

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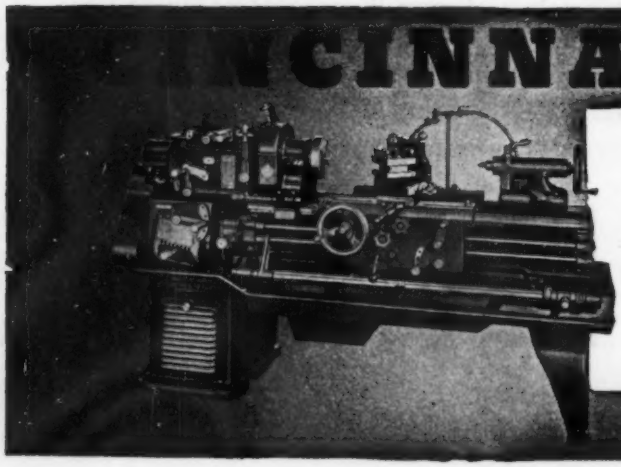
EAST PROVIDENCE, R. I.



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THE CINCINNATI LATHE & TOOL CO.
Rogers Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

GEOMETRIC

Pointers

FOR SAVING HIGH SPEED STEEL

No. 8
Resharpen Milled Chasers on the Chamfer

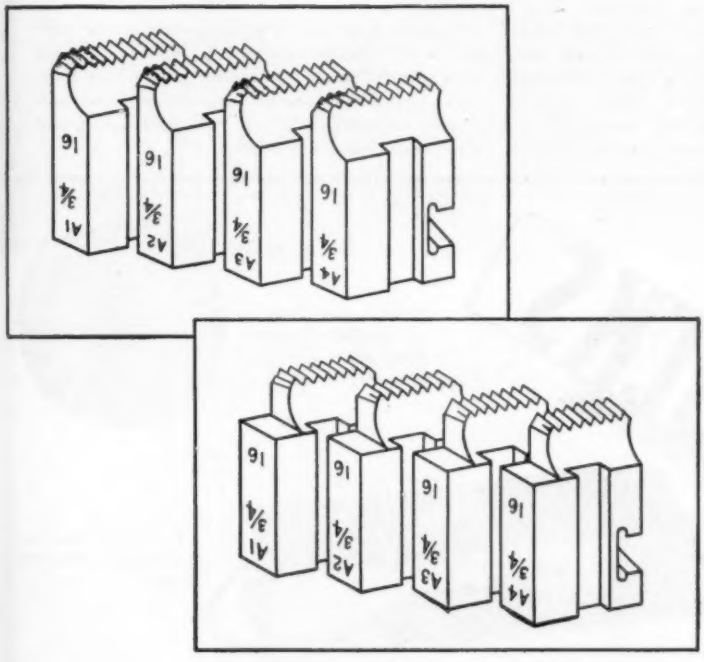
Resharpen Chasers *frequently*—before they become dull.

Resharpen them *uniformiy*. The width of land or thickness of cutting edge should be uniform in all Chasers of a set. The chamfers should be uniform in length and clearance. Do *not* resharpen Chasers free-hand. Buy or make a suitable fixture for holding the Chasers.

Regrind Milled Chasers *on the chamfer*. Usually you can do all of your resharpening at the chamfer, but once in a while you may have to touch up the cutting face. If you do, take only a light cut—.002″ to .003″ should be plenty at one resharpening.

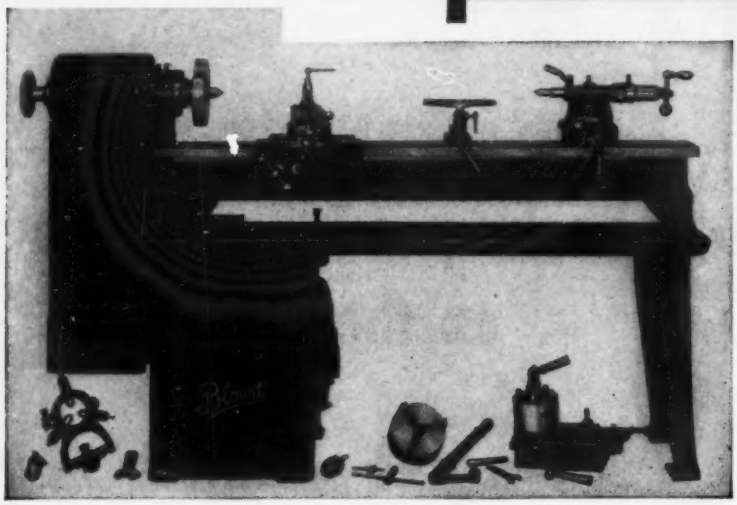
If your Milled Chasers chatter, lap them together to restore the bearing. Lap the opposite Chasers of a set together, using fine emery and oil as a lapping medium.

Remember, High Speed Steel is scarce. *Chasers of High Speed Steel are extremely valuable.* To waste them may mean the holding up of important weapons of war at a critical time. It may even mean the life of someone near to you. The Geometric Tool Company, New Haven 15, Connecticut.



Above is shown how a set of chasers with worn or chipped teeth (top illustration) can be recessed and made serviceable for many more jobs of thread production. After recessing, the chasers must be rechamfered and, if the entire cutting face is dull, it should be touched up slightly, removing only .002″ or .003″.

The Geometric Tool Company is listed on the Treasury Department's Roll of Honor of those companies whose employees contribute at least 10% of their earnings, through the Payroll Savings Plan, for War Bonds. Buy War Bonds each payday for a shorter war, a quicker Victory, and financial security for yourself in peacetime.



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MODEL B-4
SPECIAL PURPOSE LATHE

• • •

Meeting the need for a machine to handle a particular type of work . . .

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Send for Bulletin D-18 giving detailed information on the complete Blount line of special application lathes.

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J. G. BLOUNT CO.
EVERETT, MASS.
U. S. A.

Equipped with a ½ HP. 4 speed ball-bearing headstock motor-in-leg, the Model 4B Blount Lathe provides speeds of 575, 850, 1125 and 1725 R.P.M.

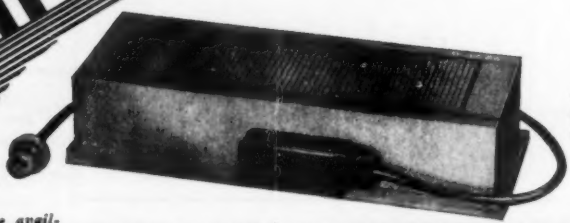
This machine can also be furnished with reduction geared motor mounted on adjustable hinged motor bracket and belted to head. With this arrangement, spindle speeds of from 185 to 1356 R.P.M. are available. Other spindle speeds can also be furnished.

The standard machine has an 11" swing and an 6' bed length. Other bed lengths are optional.

Standard equipment includes a 4-speed drum controller, magnetic starter with pushbutton and fuseless disconnect switch. Spindle nose is 2⅜" dia. 10v threads per inch. Spindle is fitted with hand wheel draw-in mechanism to accommodate Rivet No. 6 collets, ⅛ to 1" capacities. Other equipment includes hand-feed carriage and compound rest, full set-over swivel tailstock, belt, belt guard and belt shifter. Various accessory equipment can be furnished.

WALKER MAGNETIC CHUCKS

Style B Face Plate — in standard diameters from 10⅛" to 36⅛" inclusive.



No. 617 Bar Pole Face Rectangular Magnetic Chuck.

DEMAGNETIZERS
Walker DEMAGNETIZERS are available in standard D.C. and A.C. types for either 110 or 220 v. Ask for Bulletin K7 giving detailed specifications.

A FULL LINE OF PROVED STANDARD DESIGNS

Walker offers prompt and complete service on magnetic chucks by carrying in stock a considerable line of Rectangular and Rotary types for use on all surface and internal grinding machines built by American machine tool manufacturers. These units—for grinding, milling, planing and turning operations—are of proved design and are available in such a complete range of sizes as to enable you to select standard units for practically any chucking problem. Write for bulletin W4 giving detailed information.

Also special CHUCKS *for special* NEEDS

The design of Walker Magnetic Chucks is such that "specials" can be developed and furnished at prices only slightly more than standard units. If you require special magnetic chucks for special purposes, consult Walker and be assured of prompt, economical service.

O. S. WALKER CO., INC.
WORCESTER, MASS.

Another "FIRST" by Saw-way!

147 PLUGS—
4 HANDLES—
IN PLASTIC CASE

Complete Master Set of Standard Plug Gages

For the first time—a complete Master Set of standard plug gages for hole inspection, including 147 plugs and 4 handles. Plugs are set in increments of 1/64ths, starting at 1/4" and going to 1". There are three plugs of each nominal size—.0005 over, standard, and .0005 under.

All plugs are deep-frozen before finish grinding to relieve internal strain and provide accelerated aging, and are held to gage makers' (X) tolerance, lap finish.

The plastic case has a transparent cover which presents a clear view of the contents and instantly indicates a missing plug.

Sav-Way Plug Gages are produced by skilled gage makers; they have been proven in actual use on aircraft and ordnance parts of the highest accuracy.

KEEP AN EYE ON

Send Coupon for Detailed Description and Price

SAV-WAY INDUSTRIES
Box 117, Harper Station, Detroit 13, Michigan
Please send descriptive literature covering Sav-Way plug gages.

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Position_____

Firm_____

Address_____

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Saw-way INDUSTRIES
Machine Tool Division
4875 EAST EIGHT MILE · DETROIT, MICHIGAN

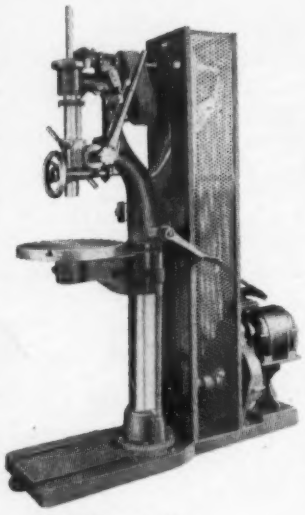
PRODUCERS OF SAV-WAY HAND AND HYDRAULIC INTERNAL GRINDERS · SAV-WAY GOLD SEAL SPINDLES · PLUG GAGES · PRECISION AIRCRAFT AND AUTOMOTIVE PARTS

DRILL HOLES UP TO 1½" with speed and perfect accuracy on this IMPROVED MOTOR DRIVEN BACK-GEARED MACHINE . . . .

The 21-inch Royersford-Excelsior Upright Power Drill is modern in every detail and combines simplicity and speed with strength and rigidity.

Gears are machine cut, bearings are generous in size. By merely sliding back gears, a quick change can be made from a plain drill to a back-geared machine. Spindle is equipped with ball thrust bearings top and bottom.

Other features include: 8 speeds with 3 distinct and complete feeds—power, hand screw and lever; spindle is counterbalanced and provided with automatic stop and quick return; table is raised and lowered by quick action screw.



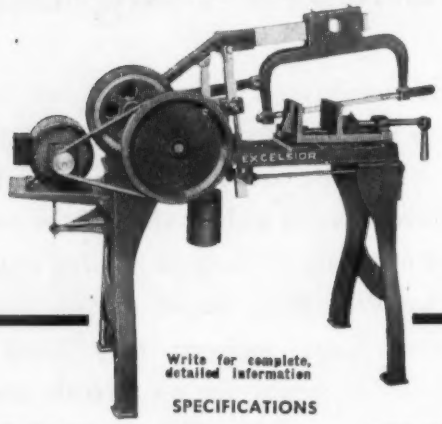
SPECIFICATIONS

Distance Table to Spindle—29"
Diameter of Table—18"
Spindle Traverse—9"
Hole in Spindle—No. 3 or No. 4 Morse Taper

Send for complete detailed information. Immediate deliveries now available.

ROYERSFORD FOUNDRY & MACHINE CO., Inc.
200 MAIN ST., ROYERSFORD, PENNA.

FASTER CUTTING and LONGER BLADE LIFE are assured by this powerful economical HACK SAW . . .



Write for complete, detailed information

SPECIFICATIONS

Length of Blade— 12" or 14"
Stroke—6"
Cutting Capacity— 6" x 6"
Swivel Vise adjustable to 45° angle

The No. M2A Royersford-Excelsior Power Hack Saw, with V-belt motor drive, combines features which assure fast cutting with blade breakage reduced to a minimum.

Blade is lifted automatically on return stroke and placed in contact with work on cutting stroke. Saw feed is by gravity, another feature which contributes to protection against blade breakage and buckling and at the same time assures greater cutting efficiency.

Other features include drive through milled gears which results in more power, and an automatic shut off which stops blade on backward stroke and disengages gear on motor.

Interchangeable swivel vise can be quickly replaced when necessary. Immediate deliveries available.

ROYERSFORD FOUNDRY & MACHINE CO., Inc.
200 MAIN ST., ROYERSFORD, PENNA.

Do you know gages and their proper use?

What is the proper kind of gage for a specific type of work? How are gages constructed? How are they used? Fred Colvin, out of his wide and intimate experience, has set down in a practical, workable manual the essential facts about gages of all types—how they are made, how to use them, which types are best for specific jobs, how to use them in inspection work.

Gages and Their Use in Inspection

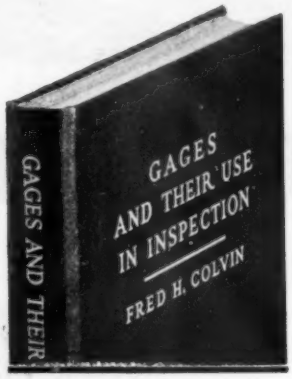
By Fred H. Colvin
Editor Emeritus, *American Machinist*

157 pages, 5½ x 8, 71 illustrations, $1.50

This book describes all types of gages, from Calipers, Verniers, Micrometers, Measuring Blocks, etc., up to the latest electrolimit gages. Tolerances, limits, and allowances are carefully defined and explained, and many practical kinks and suggestions on inspection are included.

Here is what the book covers—

1. Gages and How They Are Used
2. Measuring Instruments In Common Use
3. Types of Gage
4. Gage Tolerances and Gage Wear
5. Gage Blocks and Dial Gages
6. Reed and Air Gages
7. Threads and Thread Gages
8. Special Types of Gages
9. Interchangeable Manufacture and Inspection
10. Salvaging and Selective Assembly
11. Kinds of Fit



"A thorough understanding of gages and their use will make it easier for both workmen and inspectors, and it may easily open the way for a workman to graduate from the machine to the inspection department."

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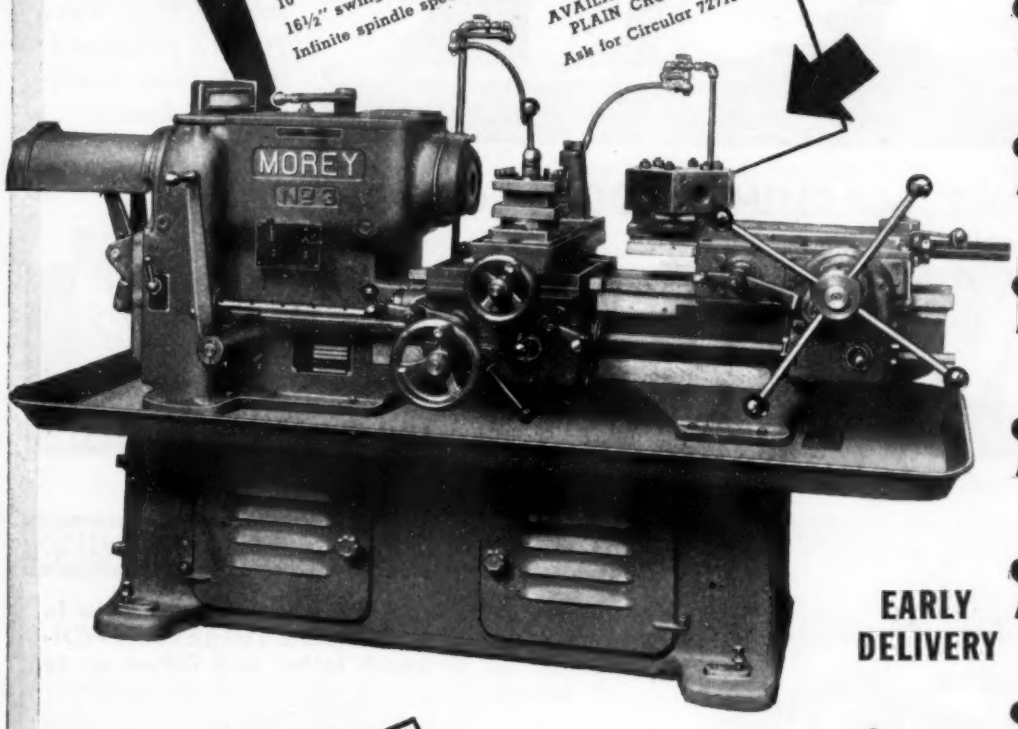
MOREY TURRET LATHES

for BAR *or* CHUCKING { UNIVERSAL or PLAIN

#3 UNIVERSAL

For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM, constant speed motor, 1200 RPM

AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 727A



EARLY DELIVERY

#2 PLAIN-GEARED

For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
Swing over bed 14"
Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
Constant horsepower at all speeds.
Ask for Circular 629A

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length
19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM, constant speed motor, 1200 RPM
AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 736A

- INFINITE SPINDLE SPEEDS —Electrically Selected—
- DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).
- GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.
- SPINDLE MOUNTED ON TIMKEN BEARINGS.
- RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS *MODERN* TOOLS WILL WITHSTAND.
- SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.
- BED MOUNTED ON CABINET BASE.
- MOTORS AND STARTING EQUIPMENT EASILY ACCESSIBLE.
- HEXAGON TURRET AUTOMATICALLY UNCLAMPED, INDEXED AND CLAMPED.
- THREE TYPES OF CROSS SLIDES AVAILABLE:
  Lever Feed
  Screw Feed
  Combination Feed*
  *Combination feed provides instantaneous selection to either lever or screw feed.
- EIGHT (8) FEED CHANGES FOR THE UNIVERSAL CARRIAGE and HEXAGON TURRET, INSTANTLY ENGAGED OR DISENGAGED BY ONE MOVEMENT OF THE LEVER.

ARMY E NAVY

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

DESIGNED AND BUILT BY

MOREY MACHINERY CO., INC

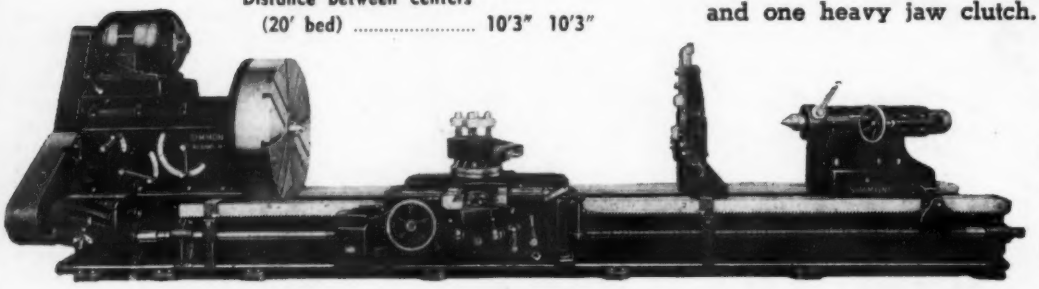
410 BROOME STREET, NEW YORK, N. Y. *Plant* 4-57 26TH AVE., ASTORIA, NEW YORK

48" and 54" HEAVY DUTY LATHE

Simmons Heavy Duty Engine Lathe is of exceptionally rugged construction. A long bearing on the bed ways assures adequate rigidity and strength of the headstock. Head is fully enclosed and all bearings and gears are constantly lubricated by positive pressure oil pumps. Nine speed changes are provided to the main spindle of the headstock through sliding spur tooth gears and one heavy jaw clutch. Boring bar tailstock designed for boring long holes of large diameter (max. diameter 8"). *Write TODAY for Descriptive Bulletins Giving Complete Details.*

SPECIFICATIONS

	48"	54"
Swing over bed	50"	55½"
Swing over carriage	36"	42"
Distance between centers (20' bed)	10'3"	10'3"



SIMMONS MACHINE TOOL CORPORATION

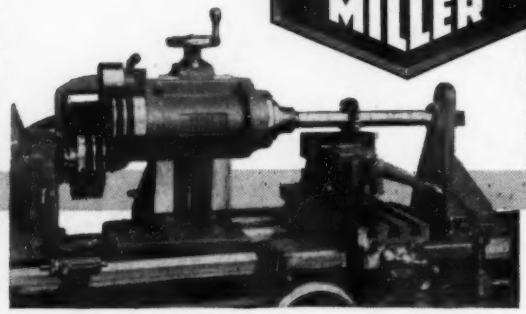
Main Office: 1759 NORTH BROADWAY, ALBANY 1, N. Y. *New York Office:* 149 BROADWAY

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES

Makes a Milling Machine out of your lathe in 3 minutes!

GLOBE MILLER



Quickly attached to your lathe, the Globe Miller, with accessories, does all types of precision milling, yet costs only a fraction as much as a heavy milling machine. Increases lathe swing 5 to 10 inches, depending on lathe size, uses all lathe speeds and feeds. Write today for descriptive folder.

GLOBE PRODUCTS MFG. CO.
3382 Robertson Boulevard Los Angeles, California

DON'T WAIT FOR TURRET LATHES

Convert any engine lathe into a turret lathe in 15 seconds with JEFFERSON TURRET ATTACHMENTS. To fit bench lathes and lathes up to 24" swing.

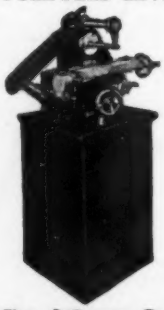
● This new modern TOOL-POST TURRET, (below, right), made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held.

6 Days Delivery

● Then there's the completely modernized 5-tool TAIL-STOCK TURRET (below, right), made in 4 sizes to fit small bench lathes and lathes up to 24" swing. Also the adjustable PULL-FEED LEVER. Jefferson Turrets are real production tools—substantial, rigid, accurate. They must not be confused with the small make-shift gadgets now on the market.

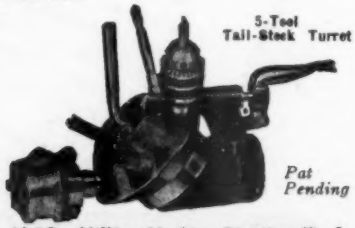
Pat Pending

4-Tool Tool-Post Turret



The Jefferson Bull-Dog Precision Milling Machine. Obtainable Power or Hand Feed.

5-Tool Tail-Stock Turret



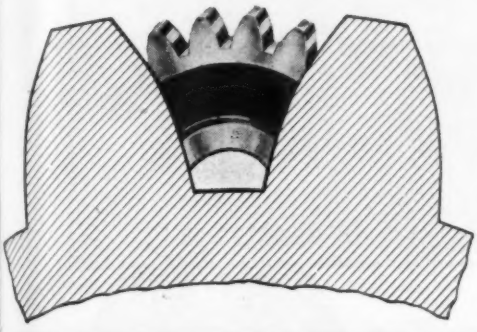
Pat Pending

● **ALSO—*Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.***

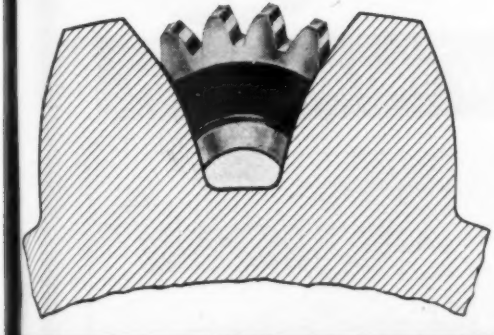
JEFFERSON MACHINE TOOL CO.
3D. SWEENEY CUTTER & FOURTH STS. CINCINNATI, OHIO

FORMED WHEEL GRINDING

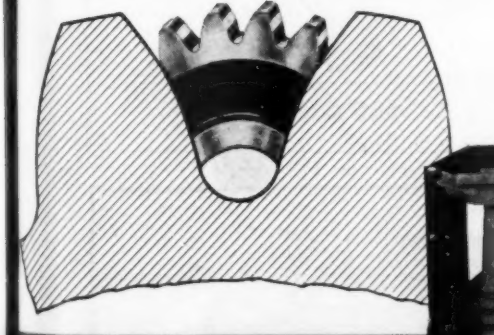
CONTROLLED ROOTS ...



STRAIGHT ROOT



DEFINITE RADIUS FILLETS



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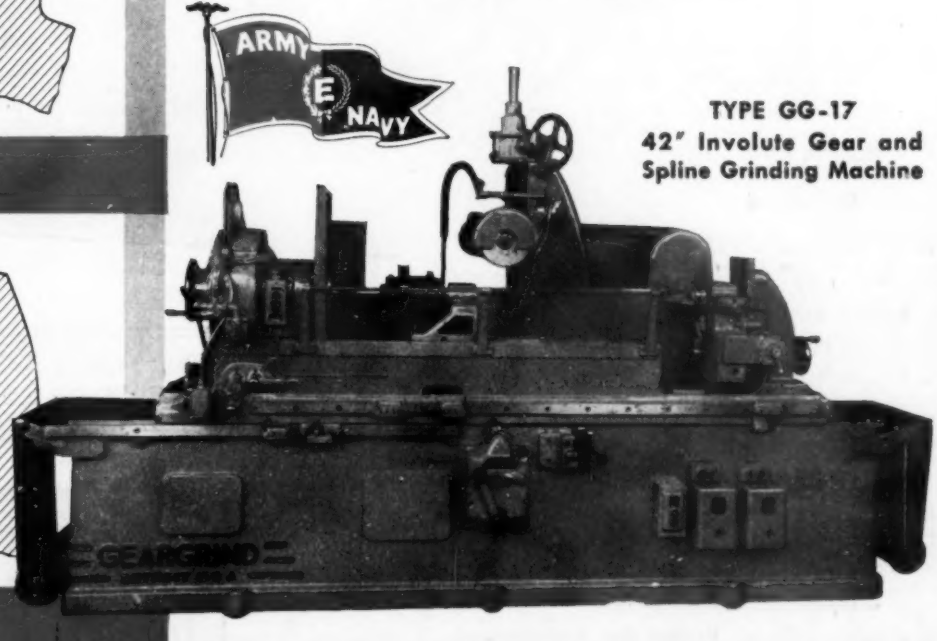
GEARGRIND Formed Wheel Grinders give you definite control of roots—just what your gear design calls for. Full radius roots and definite radius fillets that give absolute line continuity for carrying the greatest possible loads—or plain, straight roots—GEARGRIND handles them all.

For external and internal gears, external and internal involute splines, straight splines, serrations and racks, you can count on GEARGRIND for *absolute control,* constant production and the finest possible finish. Write today for full information.



TYPE GG-17
42" Involute Gear and Spline Grinding Machine

The GEAR GRINDING MACHINE COMPANY
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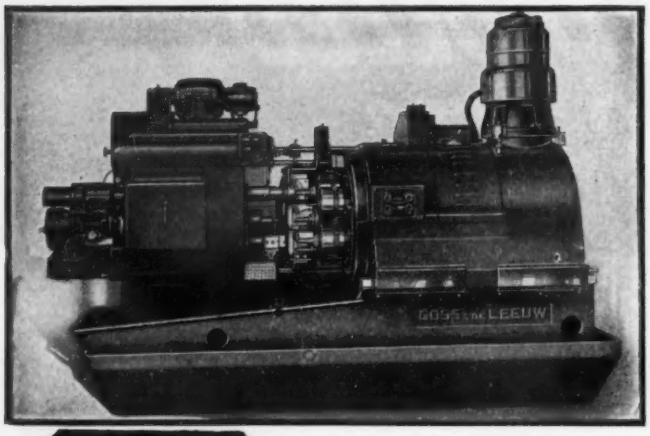
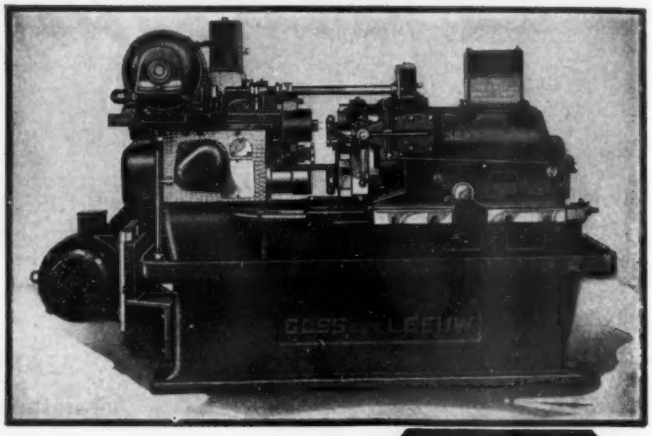
GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

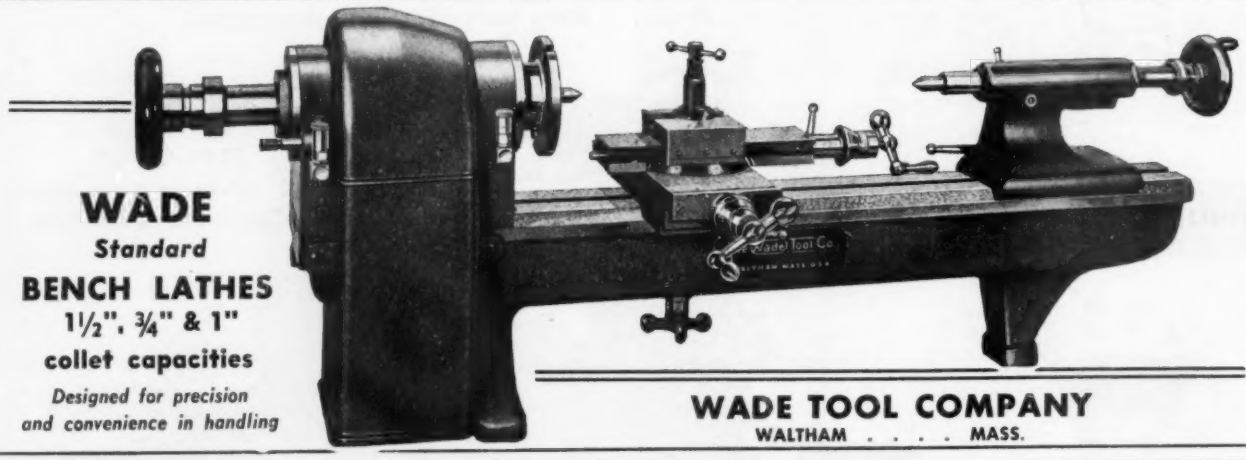
Features include:

Lead Screw Threading on both types—Pre-loaded Anti Friction Spindle Bearings—Hardened Ways—Oversize Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.



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Standard
BENCH LATHES
1½", ¾" & 1"
collet capacities
Designed for precision and convenience in handling

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WALTHAM . . . . MASS.

STEVENS SCREW MACHINES

⅝ in. and 1⅛ in. Bar Capacities.
Simplified and Highly Efficient Motor Drive.
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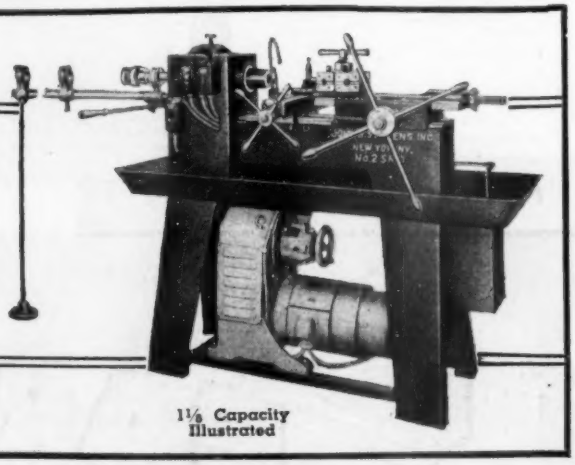
Also makers of Multiple Spindle Index Centers, Rotary Tables, Milling Machine Vises.
THIRTY YEARS' EXPERIENCE



1⅛ Capacity Illustrated

JOHN B. STEVENS INC.
474 Canal St., New York, N. Y.

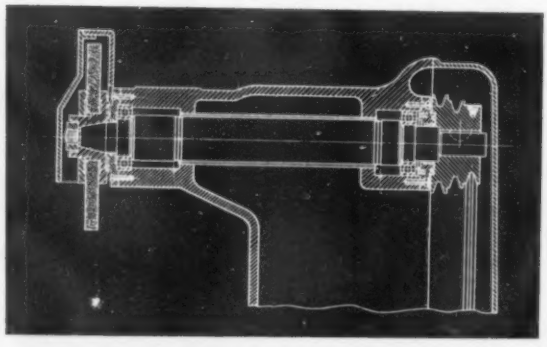
WHERE PRODUCTION COMES FIRST

COVEL EQUIPMENT IS ON THE JOB

Peak production can be maintained only with fast, accurate, easily operated machines — machines such as the Covel No. 15 Surface Grinder. Quick set-up and hand feed save priceless time on a wide range of work. Accurate, conveniently located controls enable operators to keep up fast-pace production without let-downs caused by undue strain and fatigue. . . . No. 15's many outstanding features — designed for top production — are detailed in Bulletin A-153. Write, wire or phone today for your copy and name of nearest dealer.

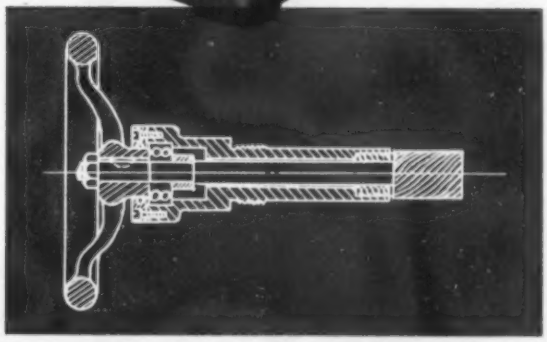
Built-in Wheel Truing Device. (Special attachment).
V- and Flat Table Ways.
Elevating Hand-Wheel and Floating Pointer. Graduated in .001 which are ¼" apart.
Plenty of Knee-room for operator's comfort.
3-Speed V-Belt Drive. Quick change of speeds to compensate for grinding wheel wear.

COVEL
No. 15
6" x 18"



Ball Bearing Spindle

Completely dust-protected. Spring pre-loaded to automatically take up end-play and wear. 300 lbs. total load.



Ball Bearing Quill for Hand Feed

★ ★ ★ Spiral gear on end meshes with rack under table for smooth operation. Completely dust-protected.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

SOLVES MANY PROBLEMS

Install Morrisflex Equipment and watch your Production Curve shoot up, and your Overheads go down. For Grinding, Buffing, Scarfing, Frazing, Polishing, Rotary Filing, Drilling, and similar operations, Morrisflex is unrivalled.

YOU SAVE TIME, LABOUR & ENERGY WITH

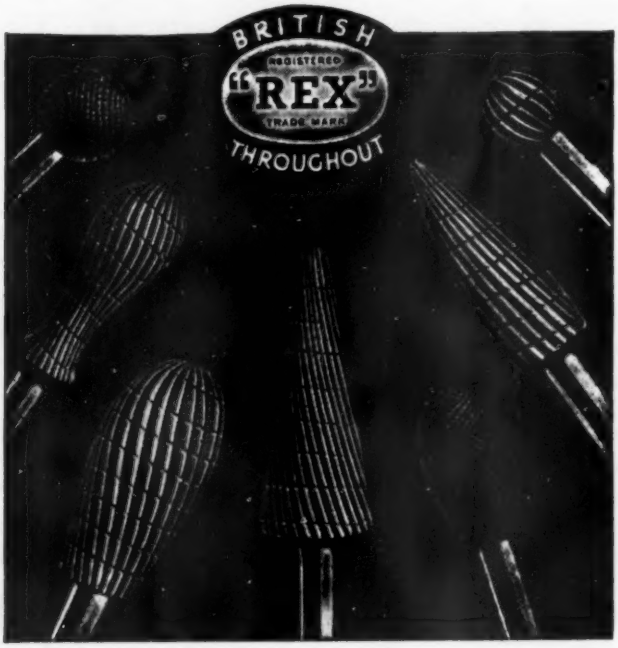
Morrisflex

FLEXIBLE SHAFT EQUIPMENT & REX ROTARY FILES & CUTTERS

Illustration shows Flexible Shaft Machine Model M 103 Pedestal Type with Casters and Tool Tray. ½ h.p. output with three speeds, 1,000, 2,800, and 6,000 r.p.m.

Morrisflex equipment is standardized in the leading Aero and Aero Engine Factories, and other important manufacturing concerns of many kinds.

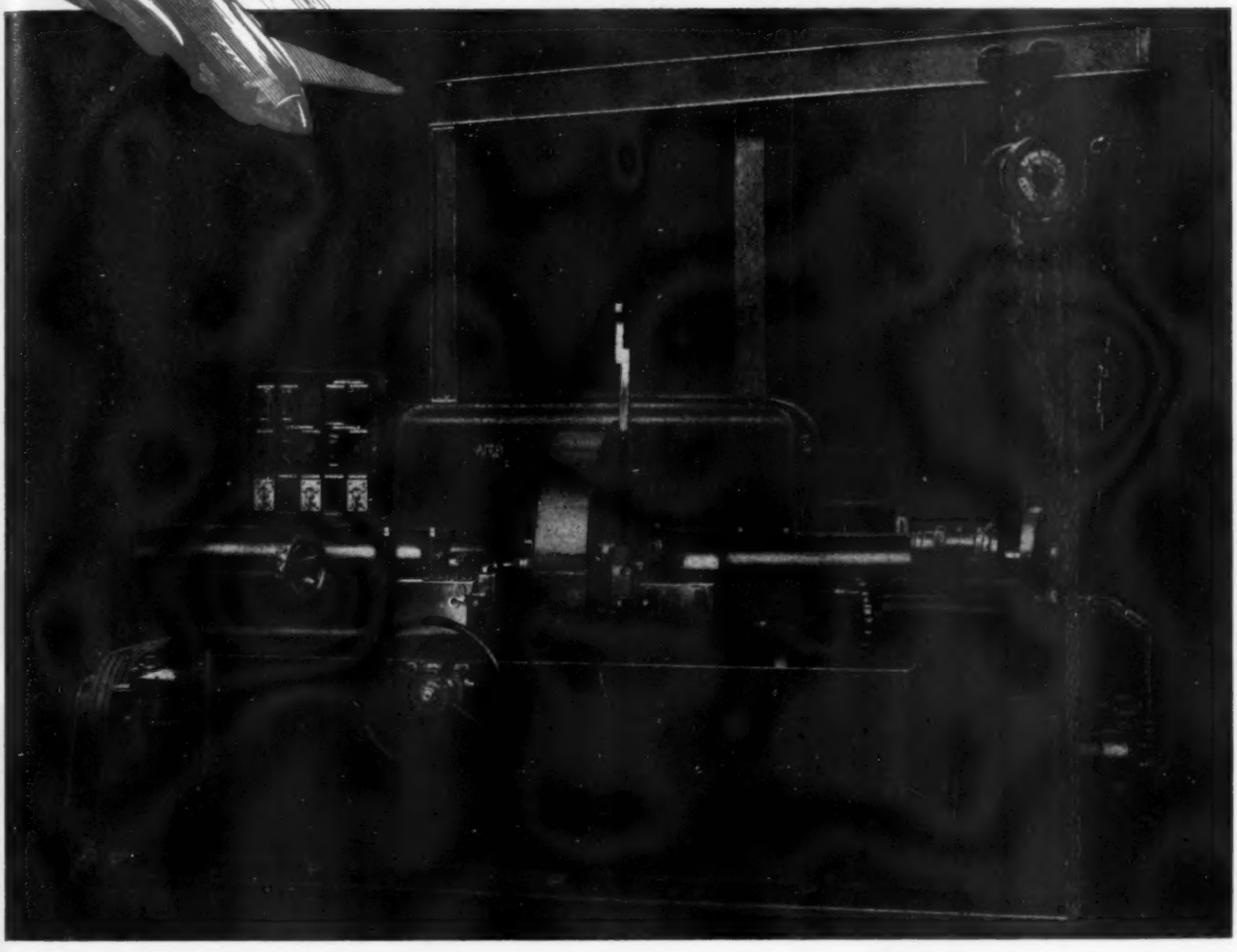
"Rex" Rotary Files and Cutters are unrivalled and standard sizes are in constant production. "SPECIALS" are made to order.

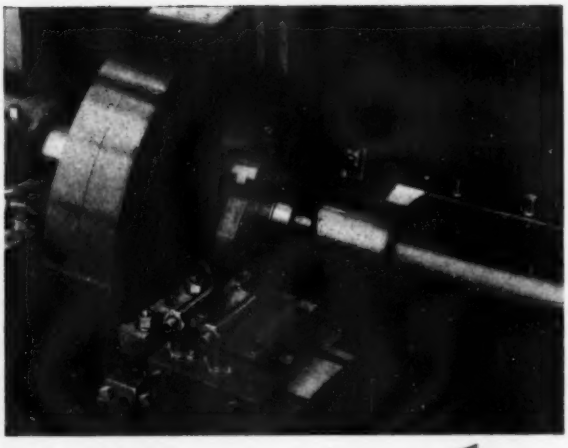


B. O. MORRIS LTD.

SHIRLEY, BIRMINGHAM, ENGLAND

WICKES AUTOMATIC
CENTER DRIVE CRANKSHAFT LATHE





This efficient new Wickes Model CH-8 Automatic Center Drive type lathe is ideal for machining the main line bearings, stub-end, flange and oil slinger complete on crankshafts for airplane, truck and tractor both gasoline and Diesel engines. By setting up duplicate lathes, the second tooled for finish turning the same parts, you can save considerable time and labor by eliminating rough grinding operations.

View above shows lathe with loading device. View at left shows tooling for machining rear end of two throw crankshaft.

Entire operation is automatic and controlled by an electrical push-button panel. Write today for complete facts about this and other Wickes automatic lathes.

Wickes Lathes CUT COSTS • SPEED PRODUCTION

WICKES BROTHERS • SAGINAW, MICHIGAN • EST. 1854

Crankshaft Turning Equipment • Double-End Boring, Heavy Duty Engine, and Special Production Lathes • Simplex Blue Printers

Knock-Out Engineers have an important Announcement to make

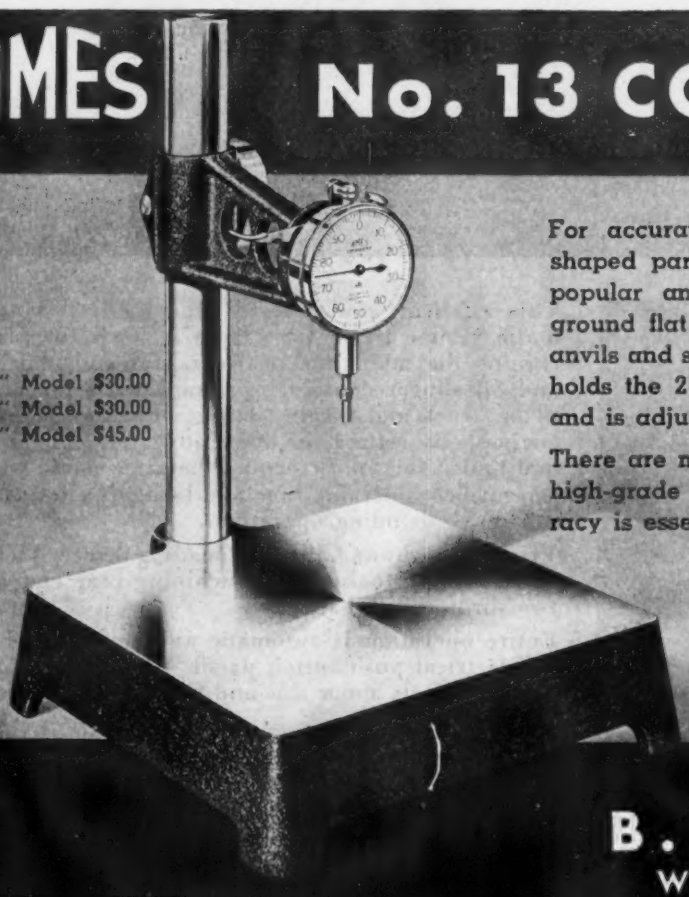
KNOCK-OUT

THE MODEL B 600
UNIVERSAL TOOL GRINDER
is now coming off the Assembly line!
IT'S NEW • IT'S FAST • IT'S ACCURATE

A Production Machine as well as a Tool Grinder . . .
WRITE FOR LITERATURE

K. O. LEE CO., ABERDEEN, S. D.

AMES No. 13 COMPARATOR



.001" Model $30.00
.0005" Model $30.00
.0001" Model $45.00

For accurately measuring large, small and odd shaped parts speedily, this No. 13 Comparator is popular and attractive. The 8" square base is ground flat on top and often fitted with V blocks, anvils and stops of various kinds. The bracket which holds the 2¼" indicator extends 4" over the base and is adjustable for measuring up to 6".

There are many uses for this inexpensive, durable, high-grade Comparator in every shop where accuracy is essential.

SEND FOR CATALOG

B. C. AMES CO.
WALTHAM, MASS., U. S. A.

and I learned to run his Oster in a jiffy!"

Men leaving machines for military service. Experienced operators frozen to jobs. Only solution is rapid training of new operators. It's a serious problem with complicated machines. Not so with the Oster No. 601 "RAPIDUCTION" — the *SIMPLIFIED* Lathe now equipped with automatic indexing of its 6-station turret.

Capable of handling a wide variety of bar and chucking operations, including unusually heavy forming cuts, Oster "RAPIDUCTION" Turret Lathes have SIMPLIFIED the problem of training new operators rapidly to necessary standards of efficiency.

Does this seem to offer YOU at least ONE solution to YOUR problems of man-power shortage? If so, use the form below NOW!

No Time Out to Celebrate Our 50th ANNIVERSARY 1893-1943

OSTER

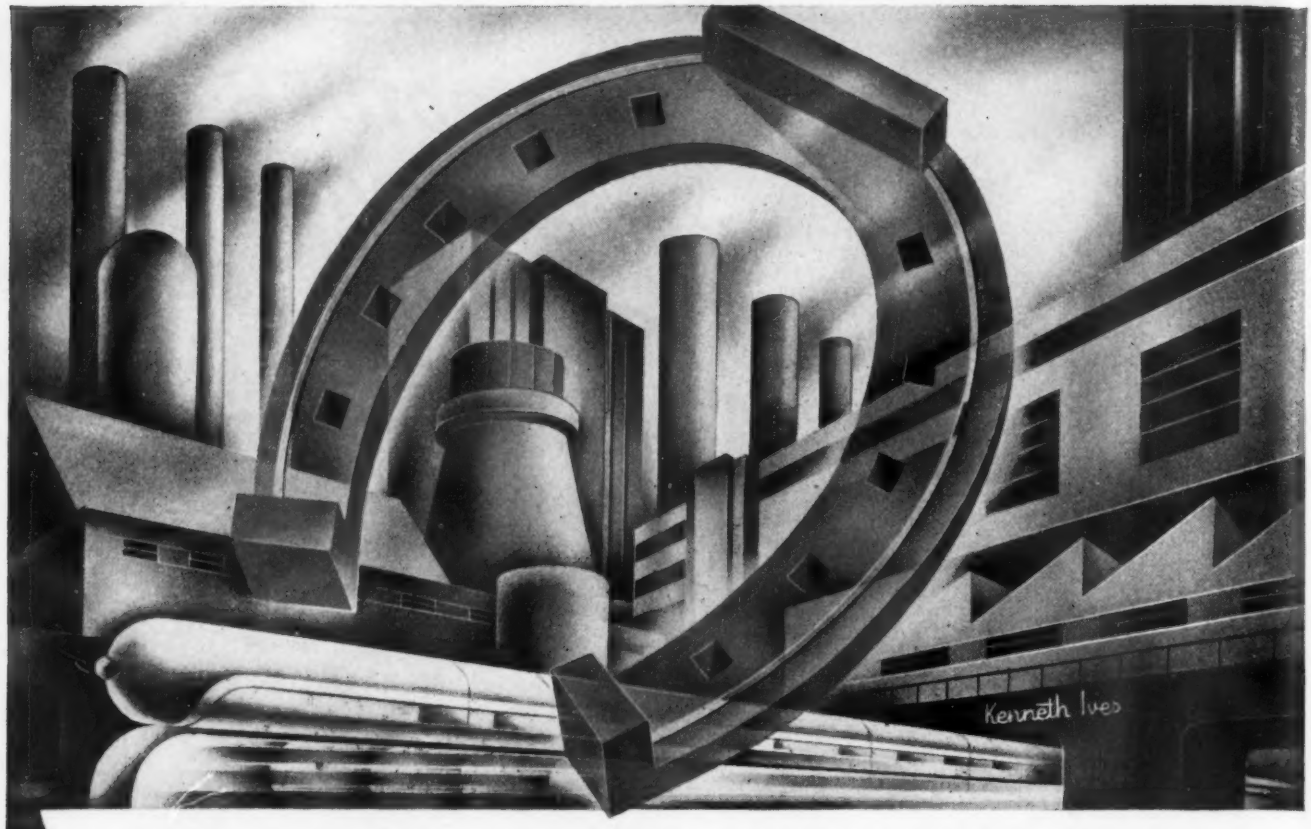
THE OSTER MFG. CO., 2049 E. 61st ST., CLEVELAND, OHIO, U. S. A.

We are seriously interested in the Oster No. 601 "RAPIDUCTION" Turret Lathe. Please send Catalog No. 601 at once.

NAME_____

ADDRESS_____

CITY_____ STATE_____



You Don't Know How Lucky You Are

... Lucky that medical directors, industrial nurses, and safety engineers are doing the fine job they are in keeping limited man-power effective and productive ... lucky that these far sighted executives developed the tools and techniques to fight occupational disease and accidents before war pressure made the need for them acute.

One such technique is a "Planned Procedure" featuring a new product designed to *combat* industrial dermatitis, not merely guard against it.

This new product, TARBONIS CREAM, has proved its effectiveness in ridding plant after plant of dermatitis due to cutting oils, chemical exposure, and some of the most difficult irritants in a dozen different industries. The proof is in its rapid acceptance by trained men in industry —the men who know.

An industrial physician and a progressive safety engineer in an Ohio ordnance plant, troubled with an average of 30 to 40 new cases of dermatitis a week, worked out a plan and procedure using TARBONIS CREAM. More than six months have passed, and not one case of occupational dermatitis has developed in that plant.

One of the world's largest plastics companies voluntarily wrote users of their irritating phenol-formaldehyde resins that a procedure using TARBONIS CREAM had proved the most effective method in twenty years of effort.

Here are examples of what medical directors, safety men, and first aid departments accomplish when they have the tools to work with, and the cooperation they must have to complete their vital work.

If occupational skin irritations are causing a problem in your plant, this "Planned Procedure" may solve it. Write for full details.

Listed below are a few, less than one per cent of the total number, of companies in one or more of whose plants TARBONIS CREAM is now at work.

THE TARBONIS COMPANY
1220 HURON ROAD • CLEVELAND, OHIO

ALUMINUM COMPANY OF AMERICA • ATLAS POWDER • BOHN ALUMINUM AND BRASS • CRAMP SHIP-BUILDING • CURTISS-WRIGHT • E. I. DuPONT DeNEMOURS • DUREZ PLASTICS AND CHEMICAL GENERAL ELECTRIC • GENERAL MOTORS • JACK & HEINTZ • NASH-KELVINATOR • WAYNE-BENDIX

Tarbonis
cream

FOR INDUSTRIAL SKIN IRRITATIONS

5 will get you 6!...

★ Today's rush orders emphasize the need to discard old-style bar-feeding. The Lipe unit is a self-contained, automatic, power feeding device that handles any material in any shape bar or tube faster, easier, more safely. It eliminates feed fingers and related parts. In a nut shell, here's why the Lipe Way is the *modern way*—

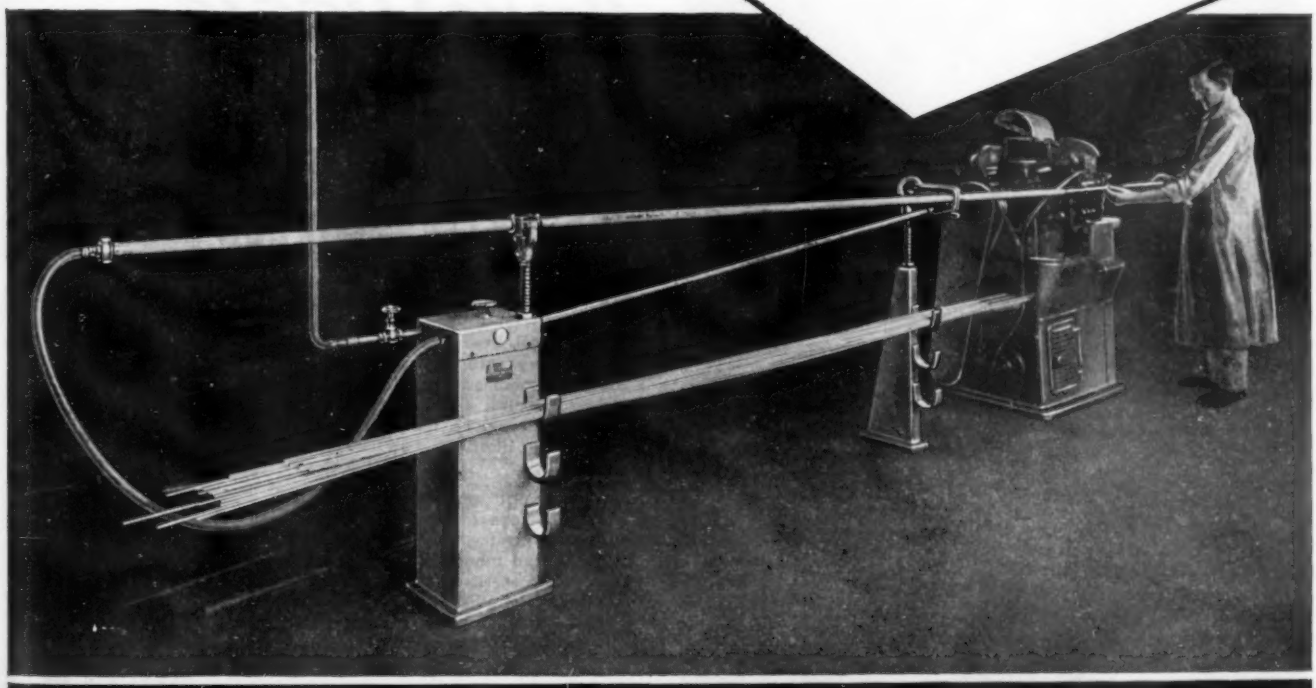
1. **15 to 20 minutes saved per 12 ft. bar.**
2. **Noise is greatly reduced.**
3. **Accuracy of work increased.**
4. **Stock is not marred or scratched.**

Lipe Pneumatic Bar Feeds are available for prompt delivery for any hand-screw machine of 2½" dia. capacity or less, and for single spindle automatics.

Ask for descriptive literature, or for consultation with a nearby Lipe technical representative.

20% INCREASE IN PRODUCTION
Averaged by Hand-Screw Machines Equipped with

LIPE
Pneumatic
BAR FEED



LIPE-ROLLWAY CORPORATION
SYRACUSE, N. Y.

MOREY *Designed and Built FOR Precision PLUS Production*

VERTICAL SHAPERS 8"–12"–14" STROKES

Four cutting Speeds . . . infinite feed variations quickly selected . . . Directional control for all movements . . . Rapid power movements in all directions . . . Brake for Ram automatically applied...OPERATOR CONTROLS MACHINE WITHOUT MOVING FROM HIS WORKING POSITION . . . Timken Bearings for Bull Gear, Shaft and Rotary Table . . .

ACCURATE, POWERFUL, FAST, FINGERTIP CONTROL

Ask for Circular No. 726A

MOREY MACHINERY CO., INC
410 Broome Street New York, N. Y.

a new name a proven tool

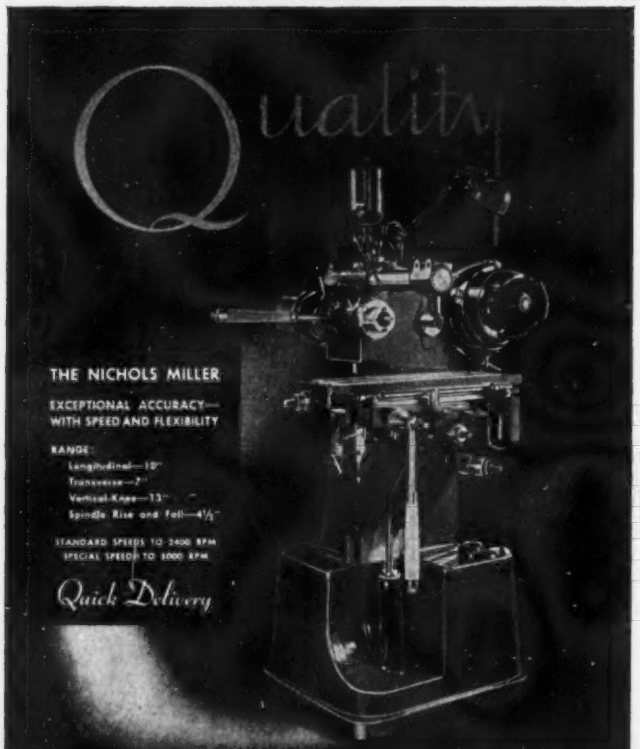
benchmaster — the new name for quality bench machine tools — offers a versatile inclinable 4-ton capacity punch press for highspeed production.

285 strokes per minute • Die Space—4¾ when Ram "Up" • Ram Adjustment—1 inch • Bolster Plate —6"x8" • Height—25" • Weight —185 lbs. • **$127.50** (less motor) **FOB Factory** • Motor (⅓ H. P.).

benchmaster tools LOS ANGELES CALIFORNIA

benchmaster manufacturing company
2952 w. pico, los angeles, calif.
formerly Duro Mfg. Co. of Los Angeles

Quality



W. H. NICHOLS & SONS
WALTHAM MASS.
Sole Distributor
NICHOLS-MORRIS CORPORATION
50 CHURCH ST. NEW YORK, N. Y.

Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*

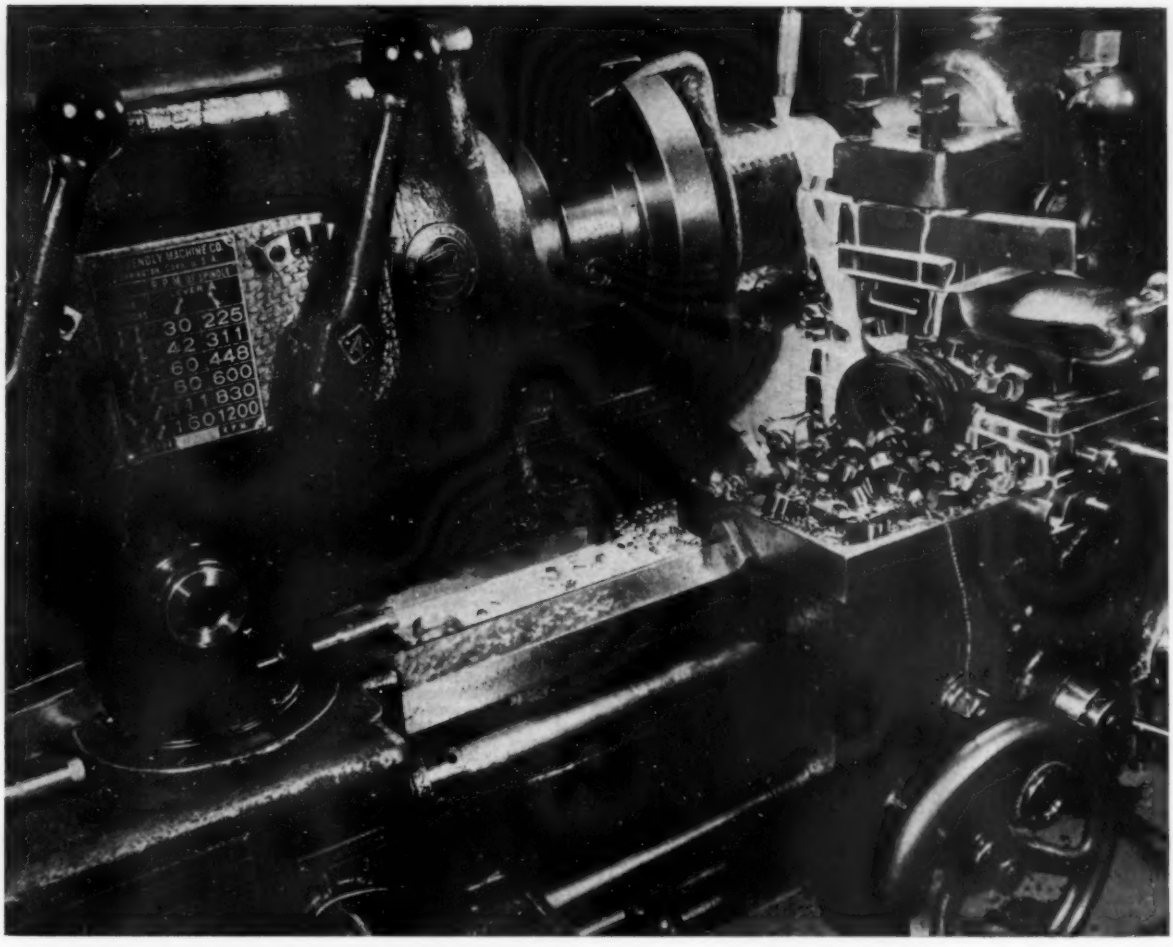
Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, taper holes, and offset holes. We also manufacture oil-grooving millers.

WRITE today for Catalog No. 15

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO



HENDEY

Many Hendey lathes are working on a 24 hour basis. This is a difficult task for any machine tool but Hendey lathes are standing up to the grind without signs of weakness or failure.

THE HENDEY MACHINE COMPANY

TORRINGTON, CONN., U. S. A.

BOSTON • NEW YORK • ROCHESTER • DETROIT • CHICAGO

DO THIS FASTER AND AT LOWER COST

WITH THE NEW *Hammond*

4-B CHIPBREAKER

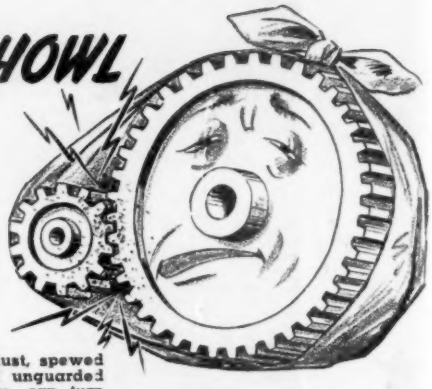
Do you tie up millers or surface grinders for carbide tool grinding jobs? Don't do it! Investigate the new Hammond 4-B — built specifically to grind chip breaker grooves easier, faster, better. Write today for BULLETIN 201 which shows how you can get *complete* and *proper* carbide tool maintenance.

V-BELT DRIVE PERMITS ANY ELECTRICAL SPECIFICATIONS

Hammond Machinery Builders INC.
KALAMAZOO • MICHIGAN

1618 DOUGLAS AVENUE
East'n Branch—71 W. 23rd St., New York 10, N. Y.

YOU'D HOWL TOO...

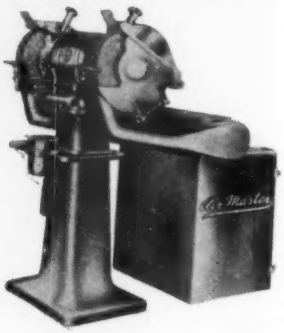


WITH GRIT IN YOUR TEETH

Abrasive grit and dust, spewed from the wheels of unguarded grinders and buffers, can turn the purr of finely honed gears on your expensive shop machinery into a discordant howl that the best lubricants won't silence.

Sure, we know that nobody expects a tool room to sound like a symphony concert, but when gears begin to clatter and bearing surfaces lose their smoothness, production takes a nosedive.

End the assault of grit and dust on precision manufacture by installing the Cincinnati Air Master on your grinders and buffers, trapping trouble at its source. The Air Master comes in three sizes to fit all grinding and buffing machines. Write for complete information.



The Cincinnati

ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS

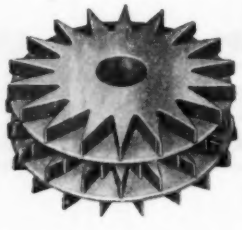
The Cincinnati Electrical Tool Co.
DIVISION OF THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI, OHIO

2676 MADISON RD.

Filtaire PORTABLE DUST COLLECTORS

The Filtaire Portable Dust Collector is a completely self-contained unit that will soon pay for itself in dozens of spots in your shop. It stops the damage caused by dust and dirt from grinding and polishing operations. The Filtaire is equipped with a replaceable Dustop filter which is inexpensive and absolutely fireproof. Plug the Filtaire into any 110-volt line and it's ready to go. Write for descriptive folder.

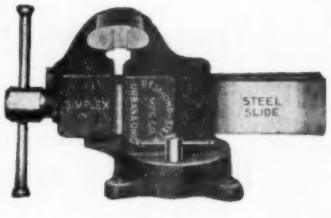
EDWARD BLAKE COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.
BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES



DESMOND
GRINDING WHEEL DRESSERS & CUTTERS

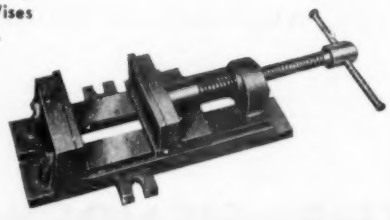
We manufacture a complete line of wheel truing tools and can supply the proper dresser for each of your grinding wheels.

SIMPLEX
Steel Slide
VISES



A full line of Machinists, Welders, Filers, Production and Drill Press & Milling Machine Vises with solid steel slides.

Write for copy of catalog "A" and name of your nearest dealer who can supply you.



ARMY-NAVY E

THE DESMOND-STEPHAN MFG. CO.
URBANA • OHIO

You get accurate, dependable results and SAVE A LOT OF MONEY—with the Delta Carbide Tool Grinder

This low-cost grinder runs absolutely true, free from vibration — for delicate grinding of carbide tipped tools.

Manufactured by modern precision methods in a modern plant, this sturdy, vibrationless Delta Carbide Tool Grinder is so well-built, so accurately machined that you can depend on especially fine results.

It is so low in cost that it can be used profitably in *any* shop — large or small. Combined with the Delta standard tool grinder for hogging down the shank steel, it gives you a perfect working combination for sharpening tungsten carbide tools, with a remarkably small initial investment.

Many outstanding features to assure accuracy and long life

The motor, contained in the head, is of the reversible type with convenient built-in reversing switch; it is equipped with self-sealed ball bearings which require no lubrication for their entire life. Manually-operated brakes on each wheel permit the grinders to be slowed down and stopped immediately for reversing.

One 60-grit and one 120-grit wheel mounted directly on motor shaft; surface speed 5200 feet per minute. Grinder also takes standard diamond wheels; has convenient water pot for bringing water to the grinding surface. Heavy, accurately ground tables with 75° tilting range. Entire sub-base quickly, easily removed for cleaning out rusty sludge. Handy, adjustable light.

Widely used in war plants

This good-looking, modern machine has made a record for itself wherever it has been installed. Get credit for discovering the low-cost Delta way in *your* plant. Investigate! Send for the new Delta catalog giving full details. M-2

TEAR OUT AND MAIL THIS COUPON TODAY

THE DELTA MANUFACTURING COMPANY
608H E. Vienna Ave., Milwaukee 1, Wis.

Please send me your new catalog giving full details on the Delta Carbide Tool Grinder and your full line of low-cost machine tools.

Name.....Position.....

Company.....

Address.....

City.....(.....) State.....
Zone

Reversing Switch

Conveniently located at front of grinder. Six-pole type, completely wired into the unit. Opens both sides of line.

ARMY E NAVY

THE ARMY-NAVY "E"
—awarded for excellence in the production of machine tools vitally needed in the war effort.

For your WORKERS!

HERE'S BETTER SKIN SAFETY ON-THE-JOB

Do cutting oils irritate your workers' skin? Do your men work with metals or solvents that make unsightly hands and arms? FEND protection answers your problem! There is the *right* FEND Cream or Lotion for protection against scores of industrial skin hazards—yours included. Proved safe—easy to rub on—invisible—easily washed off at end of work.

Write for the Descriptive FEND Brochure.

M·S·A FEND

INDUSTRIAL PROTECTIVE CREAMS AND LOTIONS

MINE SAFETY APPLIANCES CO.
Braddock, Thomas and Meade Streets
PITTSBURGH, PENNSYLVANIA

VITRIFIED

Keep production on its toes by standardizing on . . .
VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Grinding equipment—for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

. . . Cast Iron, Bronze etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels. . . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

Vitrified Wheels

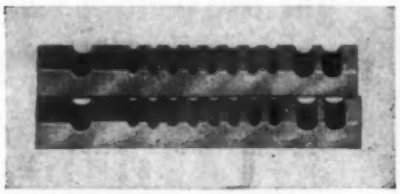
VITRIFIED WHEEL CO.
WESTFIELD MASS.

DRESSING IS SIMPLIFIED... *by the New Time-Saving* C-66... RADIUS DRESSER FOR SURFACE GRINDERS

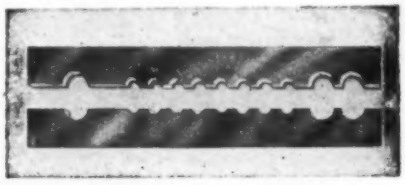
This low-priced, rugged attachment, for any make of surface grinder, dresses wheel without dismantling machine. Mounts directly on magnetic chuck. Does a one-hour job in 10 minutes — accurately — conveniently.

NOTE how this Radius Dresser and two High Speed Tool bits replace an expensive Jig Boring Machine.

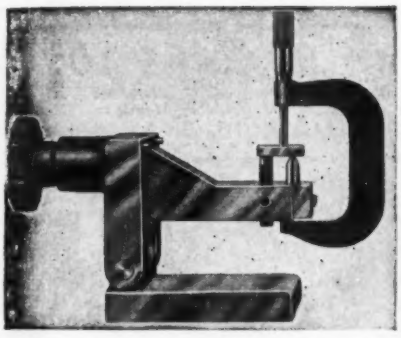
Drill Jig made with two high speed tool bits ground together on surface grinder, eight .062 holes, two screw holes, one dowel pin-hole. No drill bushings, no lapping, no hardening. Grinding time two hours fifteen minutes. Simple, easy, quick.



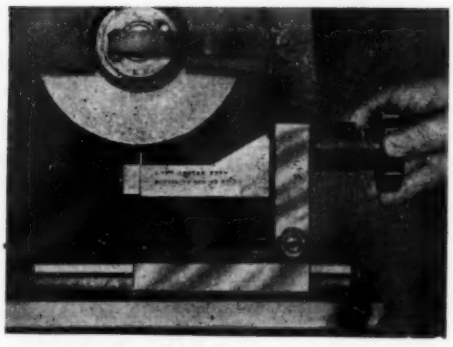
Two High Speed Tool Bits ground for drill jig.



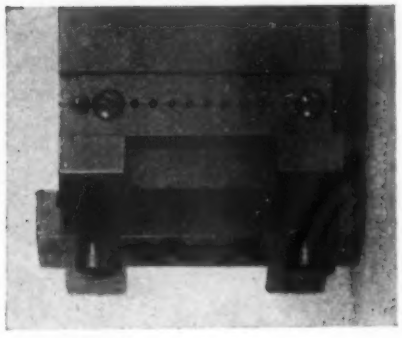
Drill jig completely assembled.



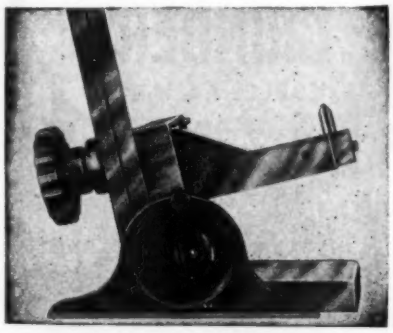
The diamond is set by simply measuring with micrometer from top of hood to bottom of arm.



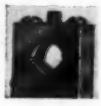
The C-66 provides an important safety feature in that hands are kept away from under the wheel.



Drill jig completely assembled.



For dressing wheels for grinding turning tools, the dresser is set at angle equal to clearance angle of tools. The C-66 is the only radius dresser with this feature.

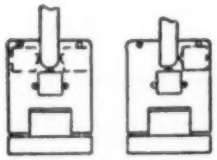


Long Wearing Chisel Point Diamond

The diamond holder is held against a ground vee in the arm. By means of this construction any size diamond up to 3/8" can be held accurately in line with the vertical center line of spindle.

.013 Male and Female Radius

.500 Male and Female Radius



180° and 90° Male Dressing

Prompt delivery from factory in Newark, N. J. Price, without diamond, $82.50, 1/4 K diamond, $5.00.

SCHULTZ & ANDERSON CO.

MACHINE TOOLS

109 C EDISON PLACE NEWARK, N. J.

Send for NEW OPERATING MANUALS

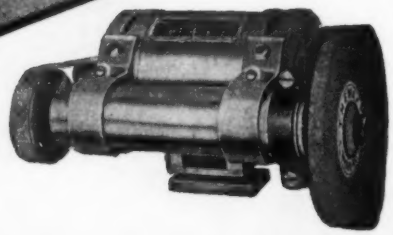
. . . now available to help you get Maximum Performance from your

THEMAC

PRECISION GRINDERS

. . . for the following types

J-2A
J-3
J-30
J-4
J-40



If you're one of the thousands of THEMAC users, you'll welcome these operating Manuals because they will help you get longer and better service from your THEMAC GRINDERS. If you've had difficulty in getting new equipment—if your Themac distributor has had to ask your indulgence until such time as he could supply your needs, these new Manuals will help you keep your present Themac Grinders in productive operating service.

In these new Manuals you'll find diagrammatic sketches of each type Themac Grinder. All details of design and construction are clearly shown; all parts are indicated by number to facilitate identification for service or for ordering replacements. In short you'll find these Manuals of outstanding help for maintenance, repair and servicing.

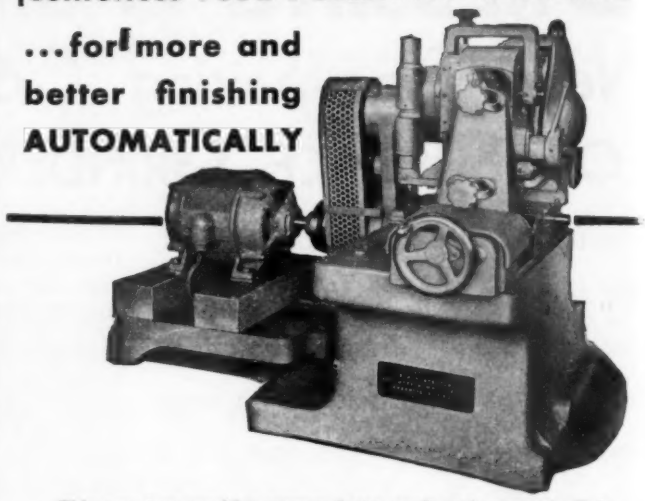
Remember, spare parts are in stock as a further insurance of assistance and prompt service.

Inasmuch as your distributor supplied you Themac Grinders, we probably do not have a record of those you are using. *In requesting copies of these Manuals will you, therefore, kindly advise the types and serial numbers of your grinders to assure our supplying the Manuals you require.*

THE McGONEGAL MANUFACTURING CO.
EAST RUTHERFORD, N. J.

No. 101 "PRODUCTION"
Centerless Feed POLISHING MACHINE

. . . for more and better finishing AUTOMATICALLY



This new type machine assures faster work at lower cost. It is designed for polishing, finishing and buffing any cylindrical work to whatever degree of finish required.

Operation is extremely simple so that high quality work can be produced even with inexperienced help. Work is fed automatically —no centering, chucking or holding is required.

All parts are readily accessible; construction is sturdy; wheels from 10" to 16" diameter can be used; work support is adjustable to suit requirements; a suitable wheel truing device is provided.

Detailed specifications available promptly on request.

PRODUCTION MACHINE CO.
Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

TYPE 10 and 14 FEATURE THE *NEW* PATENTED

NO SPRAY
NO SPLASH
WHEEL GUARDS

"You're Dry when you grind Wet"

Guards are concealed, easily accessible, maximum light and operation freedom around the wheels.

WRITE FOR BULLETIN 201

Other Hammond Grinders: "4" Combination Chipbreaker and Grinder; 6 10A, and 20S Carbide Tool Grinders.

Hammond
OF KALAMAZOO
CARBIDE TOOL GRINDERS
MODELS 4, 6, 10, 14, 20

Hammond Machinery Builders INC
KALAMAZOO • MICHIGAN

MODEL 14W "WET"

Eastern Branch
71 West 23rd St.
New York 10, N. Y.
1618 DOUGLAS AVE.

TOOL BITS ARE "WAR WEAPONS"

Insure Their Accuracy the OLIVER Way!

Tool bits and forged tools are doing a big job in this war. It's important that they be made right—and kept right! The Oliver Template Tool Bit Grinder can reproduce accurately and rapidly the correct contour of any single-point tool. Using a master template formed to the required tool shape, it produces correct top rake, accurate clearances, and sharp cutting edges. Accurate, uniform results can be obtained even by comparatively unskilled operators. Heavy, rigid and vibrationless, it can grind carbide and other high speed tools rapidly and accurately.

Keep war production accurate and fast by keeping tool bits—your "war weapons"—in perfect cutting condition. Write for bulletin explaining in detail how the Oliver Template Tool Bit Grinder can do this job—quickly, easily and economically.

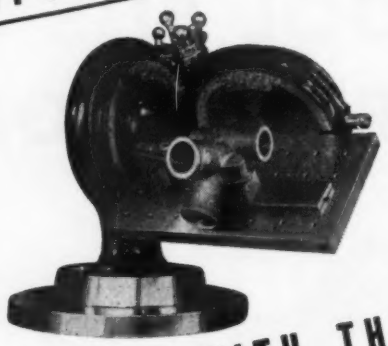
OLIVER INSTRUMENT COMPANY
1410 E. Maumee St. Adrian, Michigan

Don't Neglect Your Toolroom It's the Backbone of Production!

Oliver OF ADRIAN

AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

COMPUTE ANGLES



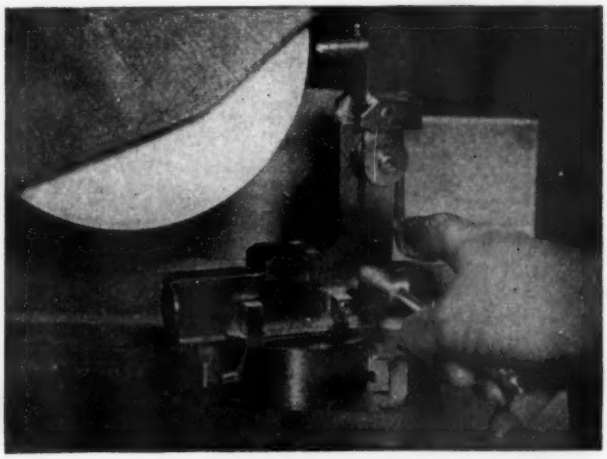
QUICKLY WITH THE

STUDLER ANGLE COMPUTER

◆ THE STUDLER ANGLE COMPUTER so simplifies layout of die work, survey of castings, and inspection of precision-machined parts that users report it is doing the work in one-half to one-tenth of the time required by the sine bar method. With this instrument, only one set-up of the work is required since its surface plate may be rotated 360 degrees in each of three separate directions of rotation: horizontally, vertically, and radially. A part having a number of angles and related angles may be surveyed in a few MINUTES. For example, the part shown on the instrument above was accurately surveyed in 15 minutes. Model "A", Surface Plate 9"x4½"x½". Model "B" (shown above) Surface Plate 16"x9"x1". Write today for Bulletin No. 2.

THE ANGLE COMPUTER COMPANY

5720-22 MELROSE AVENUE, LOS ANGELES, CALIFORNIA



An instrument of precision and versatility . . . Operation is simple requiring no high degree of skill for accuracy . . . Any one of the following can be produced with one setting:

One angle	Two angles and radius.
Two angles	Many other diversified
Concave radii up to 6"	forms to meet require-
Convex radii up to 4½"	ments.

Wheel size capacity—9½" dia.; angular travel 3"; for use on universal surface and cylindrical grinders.

Full details available on request.

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J. & S. TOOL CO. 477 MAIN ST. EAST ORANGE, N. J.

PRECISION DRESSING TOOLS

DIAMONDS for Victory

BIG-HED-NIBS LOC-KEY-SET

RE-SET-ABLE

Cooler dressing
Closer Tolerances
Micrometer Accuracy

Because: Wing key heat dissipation and absolute diamond lock nib.

• Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes 1/4 to 1/8 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid. Grinders instruction card free.

The Most Complete and Up-to-the-Minute Line of Diamond Tools for War Production
Send for Free Catalog.

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Sheldon M. Booth, Pres.
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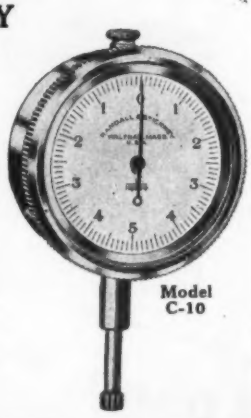
RANDALL & STICKNEY
New 1/10,000" Indicator
Model C-10

Range	3"
Diameter of case	1 15/16"
Diameter over all	2⅛"
Depth of case	⅞"
Length over all	3⅛"
Lug or Bracket—Offset, on center if desired	Hole 3/16"
Back held in position by	4 large screws
Center of spindle to center of hole in lug	15/16"
Weight	8 ounces
Stem	9/32 diam.
Dial	0-5-0 or 0-10
Graduated	.0001
Crystal	Non-breakable



Model C-10

RANDALL & STICKNEY
Waltham, Mass., U. S. A.
Makers of Gauges Since 1885

FOR ECONOMY IN LAPPING

COPPER HEAD LAPS

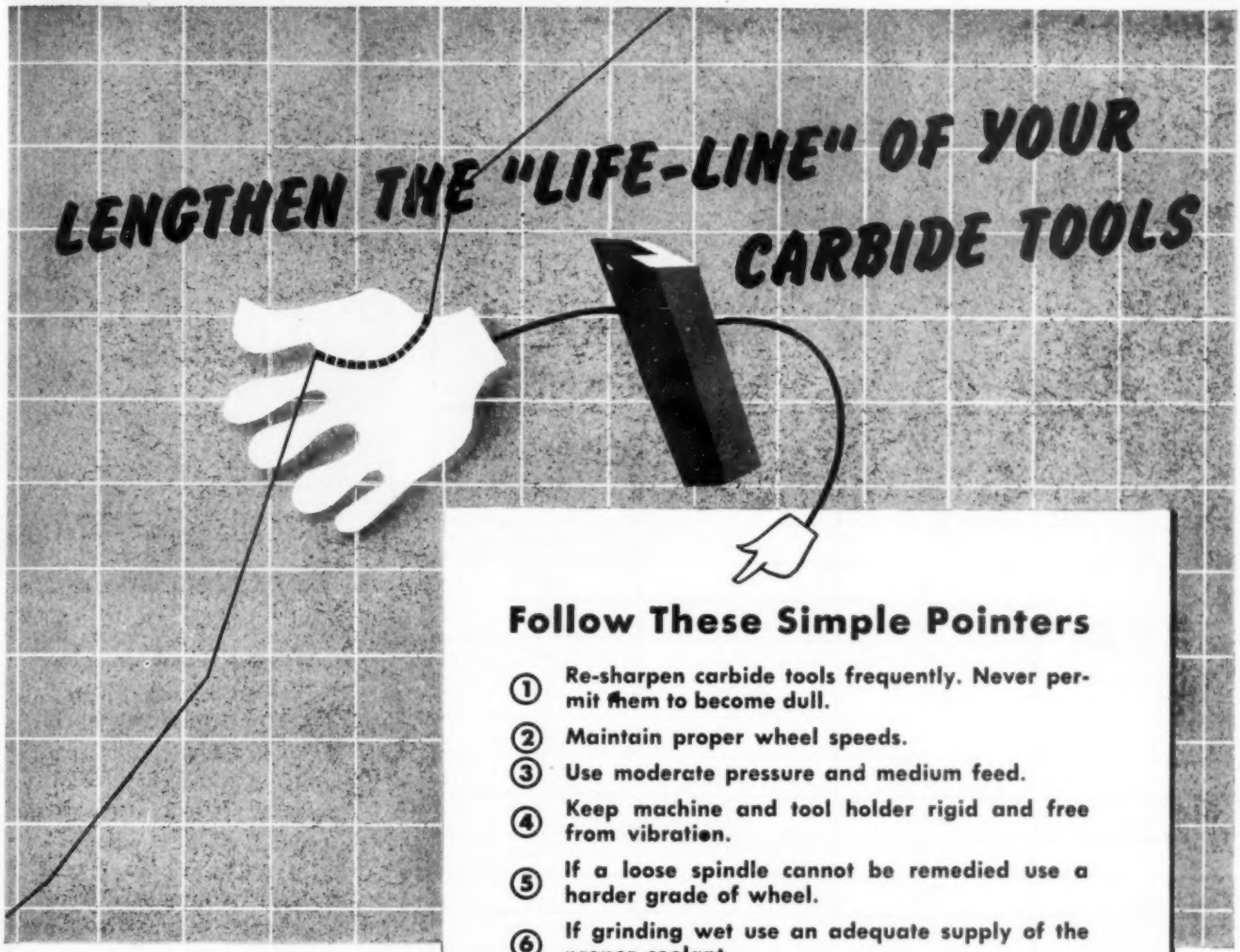
There is two-way economy in using Copper Head Laps. *FIRST*, they shorten the lapping time because they work rapidly. *Second*, they are long lasting. The only wearing part is the replaceable copper sleeve which can be expanded to maintain the proper size till completely worn out. A new, correctly sized sleeve is substituted for the worn one.

Sizes: 1/8" to 2½" from stock.

NOTE: **A LAP consists of an arbor and a copper sleeve. When ordering please be sure to state if complete laps or sleeves only are wanted.**

BOYAR-SCHULTZ CORPORATION, 2109-J WALNUT STREET, CHICAGO 12, ILLINOIS

LENGTHEN THE "LIFE-LINE" OF YOUR CARBIDE TOOLS



Follow These Simple Pointers

1. Re-sharpen carbide tools frequently. Never permit them to become dull.
2. Maintain proper wheel speeds.
3. Use moderate pressure and medium feed.
4. Keep machine and tool holder rigid and free from vibration.
5. If a loose spindle cannot be remedied use a harder grade of wheel.
6. If grinding wet use an adequate supply of the proper coolant.
7. If grinding dry do not over-heat the carbide tip.
8. Never cool a carbide tip by immersing it in water or other coolant.

9

USE MID-WEST "B" BOND WHEELS FOR ALL CARBIDE TOOL GRINDING.

MID-WEST engineers will be glad to help you select *exactly* the right "B" Bond wheels for your grinding room. MID-WEST "B" Bond wheels are manufactured in any grain and any grade, porous or dense. Reasonably prompt delivery.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

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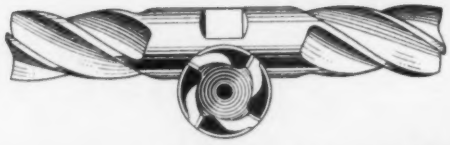
WELDON



REMINDERS

Diameter of End Mill	Tool Steel 70 ft. per Min. R. P. M.	Machine Steel 80 ft. per Min. R. P. M.	Cast Iron 90 ft. per Min. R. P. M.
1/16"	4276	4888	5498
3/32"	2855	3259	3688
1/8"	2140	2440	2750
3/16"	1420	1625	1830
1/4"	1070	1222	1375
5/16"	856	978	1100
3/8"	713	815	917
7/16"	611	698	786
1/2"	535	611	688
9/16"	475	543	611
5/8"	428	489	550
11/16"	389	444	500
3/4"	357	407	458
13/16"	332	379	427
7/8"	306	349	393
15/16"	285	326	366
1"	267	306	344
1 1/8"	238	272	306
1 1/4"	214	244	275
1 3/8"	194	222	250
1 1/2"	178	204	229
1 5/8"	165	188	212
1 3/4"	153	175	196
1 7/8"	143	163	184
2"	134	153	172

● For Shop and Instructional Use the above Data is Available as a Two-Color Wall Chart.

Send for your copy today

THE WELDON TOOL CO. Cleveland, Ohio

3000 WOODHILL ROAD

Here's the

"KNOW-HOW" of GUN MANUFACTURE

...available as reprints from *American Machinist* ARMAMENT SECTIONS

● Requests are still being received for the $1 volume on "Gun Manufacture". SORRY, BUT THIS IS NOW OUT OF PRINT. We do, however, have a limited supply of most of the Armament Sections from which the gun book was compiled. Check the list below and send for any sections you may want. Please include stamps, check or money order with your request.

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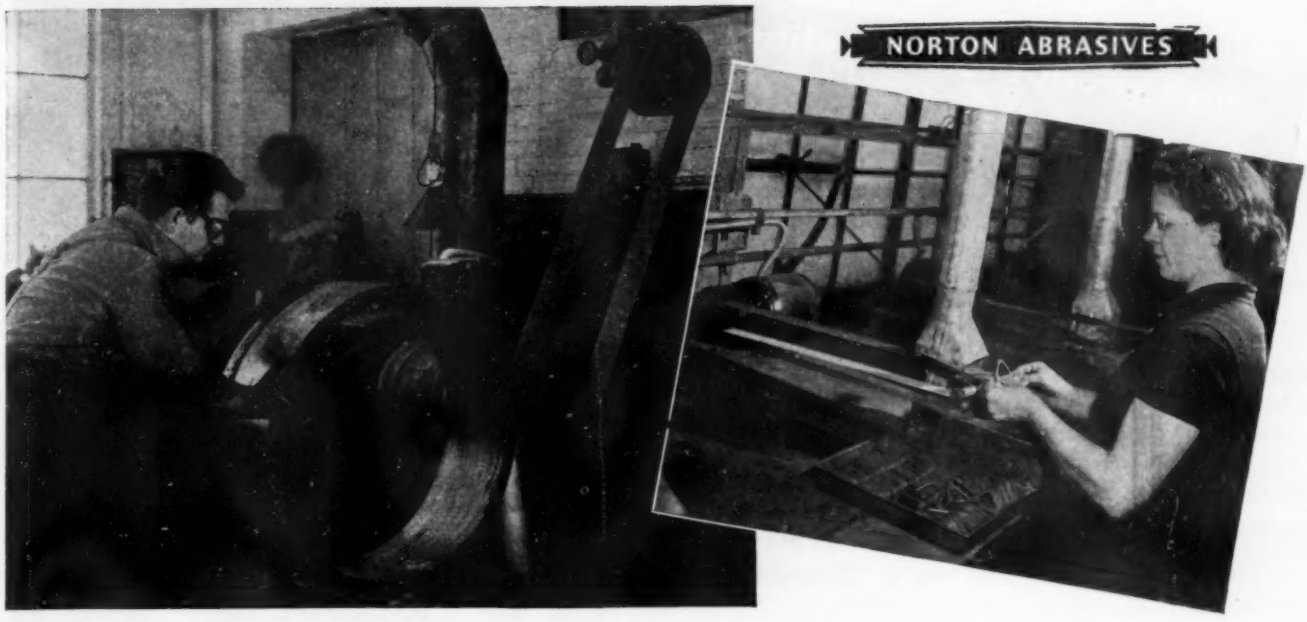

NORTON ABRASIVES

TO SPEED UP SLOW FINISHING JOBS!

FINISHING A BIG CASTING'S periphery or the interior surfaces of parachute buckles, Metalite Cloth belts or other specialties do war jobs swiftly and expertly; they follow contours so perfectly.

As in the illustrations above, our Abrasive Engineers adapt present machines to new work, either by slight changes or suggesting some simple attachment, to make hard finishing jobs easy, fast, economical.

They'll also demonstrate varied ingenious Metalite Cloth shapes like those below, that production men have nicknamed "Gadgets". One short demonstration on your own work and you'll be using them on high speed tools all over the shop to supplant hand finishing and other slow methods.

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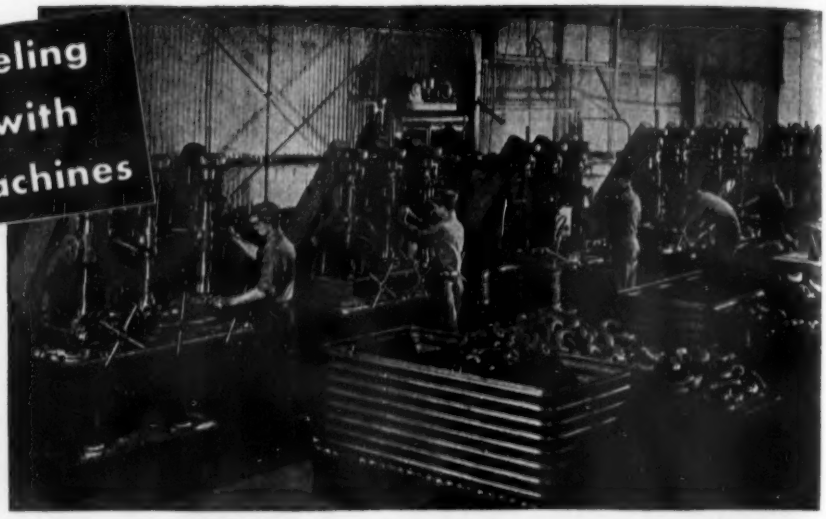
BEHR-MANNING (DIVISION OF NORTON COMPANY) **TROY, N. Y.**

High-production Beveling of Welded Fittings with BARNESDRIL Drilling Machines



This prominent manufacturer had a special machining problem of beveling welded fittings on a production basis. A battery of BARNESDRIL Gang Drills now gives the production required with the desired accuracy. The view at the right is part of the battery of 3 and 4-spindle 24" Self-Oiling, All-Geared Gang Drills set up in this shop tooled for beveling the welded fittings.

BARNESDRIL Machines Available in Sizes to Handle Work From ½" to 4" Diameter

BARNESDRIL Machines for fast, accurate drilling, tapping, reaming, boring, and similar operations are available in standard and special single and multiple-spindle, gang, and high-production units. These machines will handle work from ½" to approximately 4" diameter.

BARNESDRIL Engineers are available to help you select the proper machines for your job. Send in the complete facts...no obligation.

Free Drilling Data

Write today for free copy of Catalog A, including detailed data covering the complete line of BARNESDRIL Self-Oiling Drilling, Tapping, and Honing Machines.

Barnes Drill Co. 830 CHESTNUT STREET ROCKFORD ILLINOIS, U. S. A.

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The Original Manufacturers of Drill Chucks

The Almond Three-Jaw Drill Chucks were the first to be placed on the market. They were Pioneers in the field of Drill Chucks. For over seventy years Almond Chucks have formed a necessary part in the logical procedure of machine developments. Are made in types and sizes to fit all machine tools and portable drills.

Write for further information

T. R. ALMOND MFG. CO.
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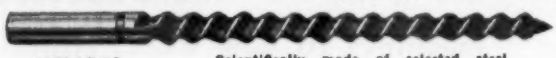
HOLMAN — BETTER, FASTER HOLE FINISHING



HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
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Drilling and Tapping Machines

(Automatic and Semi-Automatic)

LELAND GIFFORD CO.
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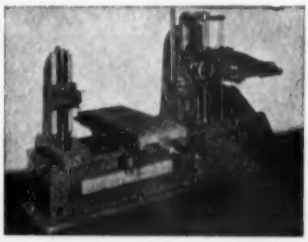
UNIVERSAL *Horizontal Boring Machine*

The only TRIWAY *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

For Little INSIDE JOBS

BAY STATE

Internal Grinding Wheels

are made closely to size, with arbor holes parallel to face and accurately centered—take heavy, fast cuts and have long life—are uniform—their porosity is predetermined.

Send for bulletin

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ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

CARD SPIRAL POINTED TAPS

for free, accurate thread cutting in deep holes

Designed for tapping deep through holes or blind holes drilled deeply enough for chip clearance at bottom of hole. Cutting is done by the first few threads milled at an angle. Chips are forced ahead of tap, preventing chips clogging in flutes, thereby increasing strength of tap and minimizing chances of breakage.

CARD SPIRAL POINTED TAPS assure free cutting, and fine quality threads. Furnished in carbon steel and high speed steel types. Fully described in Card Catalog, available promptly on request.

CARD TAPS ARE SOLD BY LEADING DEALERS EVERYWHERE

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DIVISION OF UNION TWIST DRILL CO.

STORES: N. Y. [illegible] of Reade St. Chicago, 11 S. Clinton St. Dallas, 4530 Amelia St. San Francisco, 121 Second St. Seattle, 568 First Avenue, South. Los Ang[illegible] 521 E. [illegible] Fourth Street.

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Automatic DRILLING - BORING MILLING - TAPPING Units

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
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LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF
CLEVELAND
OHIO, U. S. A.

Sensitive DRILLING MACHINES
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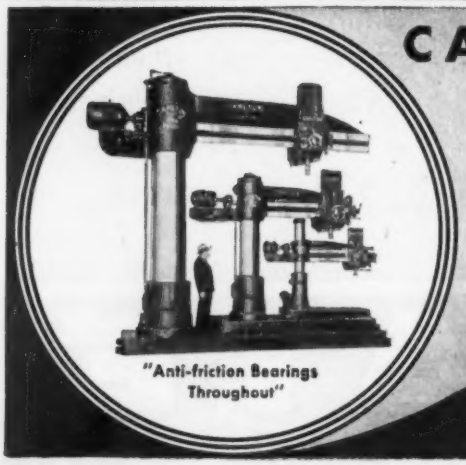
CINCINNATI OHIO

CARLTON RADIAL DRILL


"Anti-friction Bearings Throughout"

FEATURES — 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

You can handle jobs like these faster, more accurately—at lower cost with the

SUNNEN PRECISION HONING MACHINE

Hones and finishes internal cylindrical surfaces from .185" to 2.625" in diameter—with a guaranteed accuracy of .0001". Produces a super-smooth finish of 2 to 3 micro inches.

Does not require skilled labor—in many plants girls in 'teens are handling jobs in tenths.

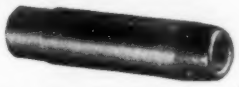
No jigs or fixtures needed—work is held in hands. Relieves big internal grinders for other jobs.

Low in cost, economical to operate. Fast—can be "set up" for any size in its range in less than a minute.

Let a Sunnen engineer check *your* job in your plant with this equipment—or write for bulletin giving complete information.

The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

Carbureter Idler Valve Jet. Hole is honed after reaming for smooth action.



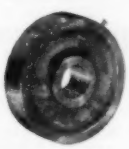
Cast Iron Valve Stem Guide. ½ to one thousandth removed—220 pieces per hour. Better finish and straighter hole.

Roller Bearing Outer Race. Finish improved from 12 micro inches to 2 micro inches.

Idle Control Valve Seat. Due to large "windows," almost impossible to get straight round hole by grinding. Sunnen solved the problem.

Bearing. A very small part. 2 micro inch finish necessary.

Hydraulic Valve. Previous method of grinding threw radius on edge of "windows." Sunnen honing eliminated trouble.

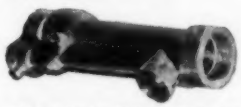


Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Hydraulic Metering Valve Stem. Hole .156" in diameter; reamed, heat treated, and then honed. Honing 3 times as fast as previous method.

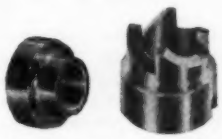
Wing Bracket. Two ¾" holes must be in line. Honing increased bearing surface and reamer life.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.



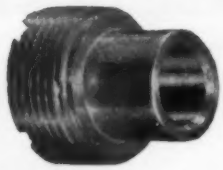
Aircraft Hydraulic Brake Cylinder. Honing three times faster than lapping—and gave a straighter hole.

Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.



Aircraft Instrument Panel Control Wire Bushing. Hole .187" diameter—held to .0002", stock removal .001", sixty per hour.

Counterbore Cutter. Very small part and because of this fact hard to handle by any other method.



Pump Shaft Bushing. Bronze; honing follows reaming. Sunnen method greatly reduced valve leakage.

Calculator Machine Gears. Cut from hole which is reamed and then honed. Honing maintains same pitch line concentricity.

Aircraft Valve Guide. Valve tappet roller pin hole honed to 6 micro inch finish.

Header Die. Life of header dies increased 3 to 9 times over lapping. Knock out pin breakage practically eliminated.

Carbureter Metering Jet. Two black bushings Bakelite. Line honing by Sunnen method.

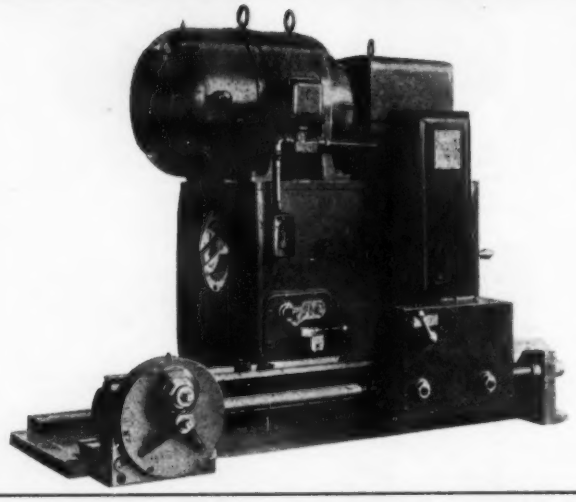
Spur Gear. By honing gears direct from heat treatment, concentricity of pitch line is maintained.

SUNNEN PRODUCTS COMPANY, 7941 Manchester Avenue, St. Louis, Mo.

Canadian Factory, Chatham, Ontario

HOEFER *Designs* SPECIAL EQUIPMENT

for machining a COAST DEFENSE GUN RECOIL MECHANISM CYLINDER with turning trunions . . . . . .



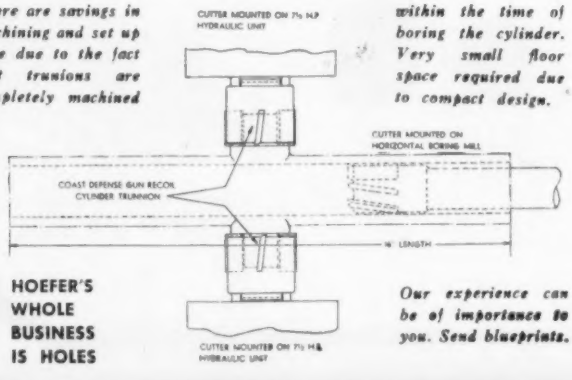
7½ HP Unit for special purpose to cover a micrometer adjustment for a hand facing operation. When using the micrometer attachment, the ball lever shown on the gear box lower right corner, engages the screw which engagement automatically throws out the hydraulic circuit. In other words, each method of motivation is entirely independent of the other.

★ This cylinder was mounted on the table of a large horizontal boring machine boring a 6-inch hole, 60 inches long. While the boring operation takes place there are two 7½ h. p. hydraulic units which turn and face the mean diameters of the true trunions.

The 7½ h. p. hydraulic units are equipped with special control valves to give rapid traverse forward—feed forward—dual return feed—return rapid traverse. Complete cycles in either direction.

Control is provided so that hydraulic circuit can be disconnected and a feed screw on the machine base engaged. Two dials enable the unit to be moved mechanically either .010 or .001 per division on the dial.

There are savings in machining and set up time due to the fact that trunions are completely machined within the time of boring the cylinder. Very small floor space required due to compact design.

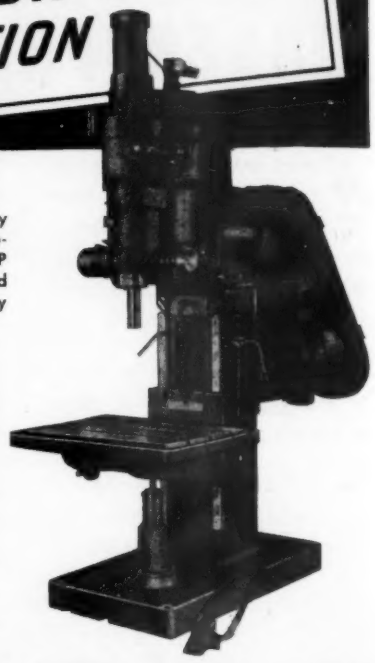

CUTTER MOUNTED ON 7½ H.P. HYDRAULIC UNIT
CUTTER MOUNTED ON HORIZONTAL BORING MILL
COAST DEFENSE GUN RECOIL CYLINDER TRUNNION
"A" LENGTH
CUTTER MOUNTED ON 7½ H.P. HYDRAULIC UNIT

HOEFER'S WHOLE BUSINESS IS HOLES

Our experience can be of importance to you. Send blueprints.

HOEFER MFG. CO. *Freeport, Ill.*

For CONTINUOUS HIGH DUTY PRODUCTION



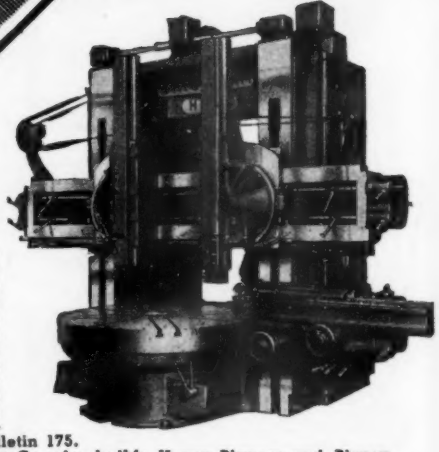
Kaufman S 10 A Hi-Duty single spindle Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾" N.C. and 1½" N.C. threads in alloy steel offers these features:

Fully enclosed . . . . lead screw and nut operate constantly in oil bath . . . positively wear - proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable. Complete information upon request.

L. J. KAUFMAN MFG. CO.

MANITOWOC, WISCONSIN

CINCINNATI BORING MILLS



MORE WORK With A HYPRO

Here are a few construction points that account for greater production and lower costs. Spiral bevel table gear — Timken equipped speed box —convenient controls — and anti - friction roller bearing rail head. Built in sizes from 54" to 12' inclusive. Write for bulletin 175. The Cincinnati Planer Co. also builds Hypro Planers and Planer Type Milling Machines.

THE CINCINNATI PLANER CO.

CINCINNATI, OHIO

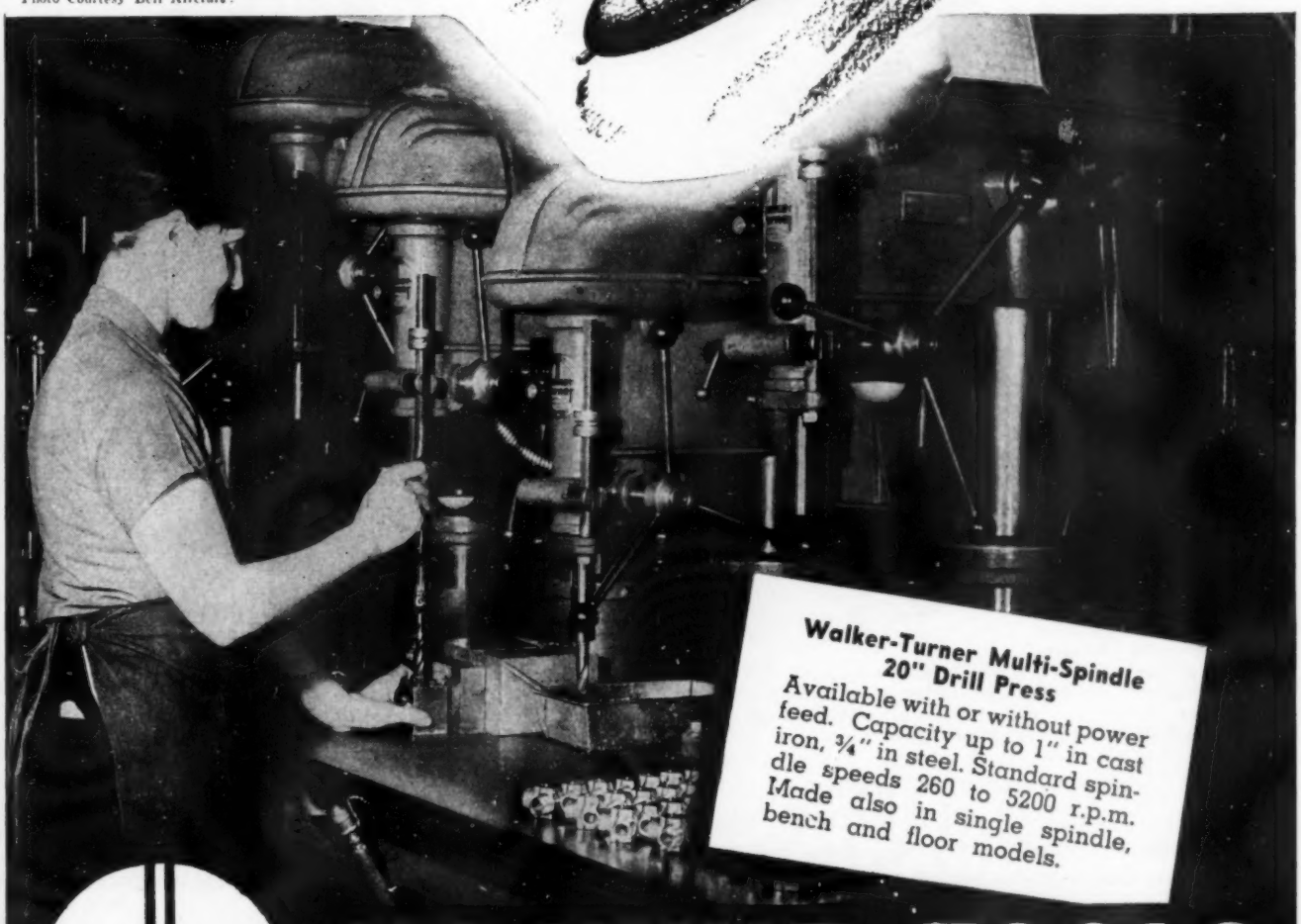
WALKER-TURNER MACHINE TOOLS

"Ring the bell" at Bell Aircraft..

War production clearly shows the advantages of using machine tools that *fit the job.* Walker-Turner units, using up to 1 H.P., handle many jobs better than heavier equipment. Simplified design enables unskilled workers to "break in" quicker; women operators find them less fatiguing, and their unusually wide range of cutting speeds permits using the optimum speed for the job. Perhaps they could cure some of your production headaches, too.

WALKER-TURNER COMPANY, INC.
4583 BERCKMAN STREET PLAINFIELD, N. J.

Photo Courtesy Bell Aircraft.



Walker-Turner Multi-Spindle 20" Drill Press

Available with or without power feed. Capacity up to 1" in cast iron, ¾" in steel. Standard spindle speeds 260 to 5200 r.p.m. Made also in single spindle, bench and floor models.

walker-turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

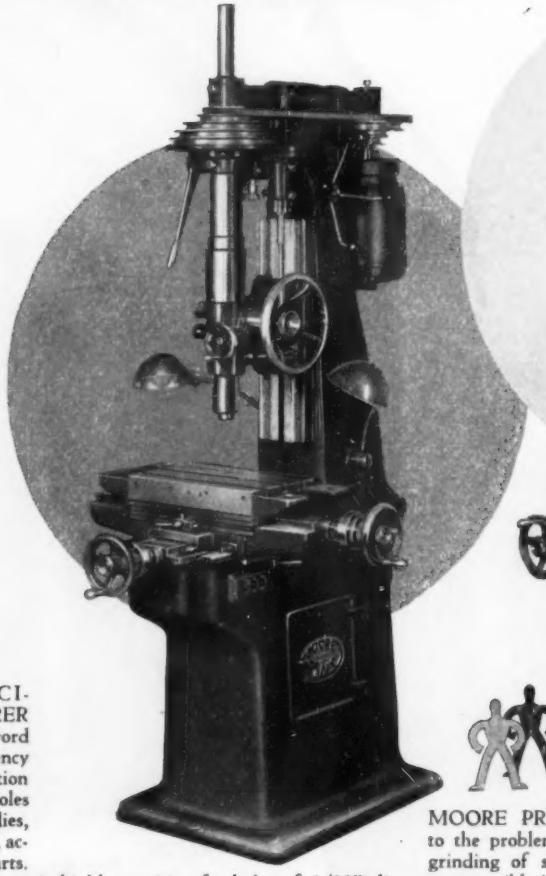
MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

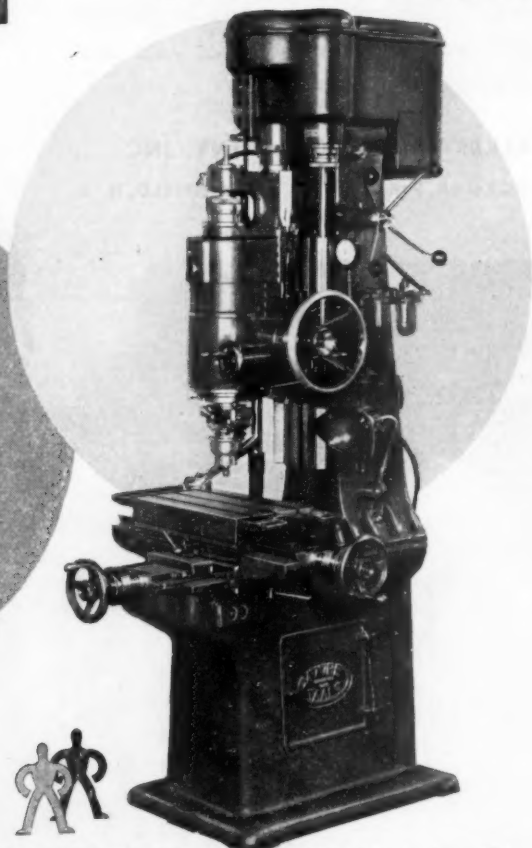
Gr⊕red Bored

by MOORE

"Partners in Production"



MOORE PRECISION JIG BORER—Here's the last word in accuracy, efficiency and ease of operation for the boring of holes in jigs, fixtures, dies, gauges and special, accurate machine parts. The Moore Jig Borer is highly sensitive for holes of 1/32" diameter or less and yet rugged for heavy cuts up to 4½". Operators can accurately spot, drill, ream and bore in one uninterrupted sequence with the Moore Jig Borer.



MOORE PRECISION JIG GRINDER—Here's the solution to the problem of correcting hardening distortions. The finish-grinding of straight and tapered holes to size and location is now possible in one-quarter the time formerly required—and with greater accuracy and fewer mistakes. The Moore Jig Grinder has a capacity to grind holes from 030" to 4", accuracy of screws of .00005" per inch and grinding speeds of 15,000 to 45,000 RPM.

☆ ☆ ☆ MODERNIZE YOUR TOOLROOM OPERATIONS with these companion machine tools. Moore-produced lead screws, ground to an accuracy never achieved before, give the coordinate location method—features of both Moore tools—definite advantages over the graduated scale and size block methods of measurement.

Ask today for full details on the Moore Jig Borer and Jig Grinder.

MOORE SPECIAL TOOL COMPANY INC

740 UNION AVENUE, BRIDGEPORT, CONN.

Faster, Finer Finish..

... Precision Holes with WETMORE TOOLS

ON the basis of production savings, Wetmore Reamers and Boring Bars have proved in industry that quality tools are the most economical. And in these days with manpower and machine capacity at a premium, it is even more important to turn out precision work, with finer finish, in less time.

Wetmore tools speed up machining, cut manhours per piece, last longer, and reduce setting time and maintenance; by a combination of engineering features found in no other reamers or boring bars.

Rigid construction with patented blade lock and extra heavy blades in Wetmore Reamers insure better finish, without digging in or chatter . . . work is held to close tolerances because threads are milled on centers, blade seats ground true with threads and blades are always bottomed . . . blades are quickly and accurately set to the thousandths of an inch . . . blades may be set out 7 to 50 times, depending on size . . . tools are interchangeable, because of Wetmore precision inspection . . . and heavier cuts may be taken because of rugged construction, scientific grinding and quality materials.

Top-flight metal working plants have found Wetmore Reamers and Boring Bars the answer to production problems.

Let us show you how they can solve yours

TOOL ENGINEERING SERVICE

Designers and tool engineers are invited to avail themselves of our consulting service on reaming and boring operations, whether requiring standard tools or tools of special design.

The two illustrations at the top of the page are Wetmore standard boring bar and adjustable heavy duty reamer. In panel: Extra heavy duty reamer . . . special reamer for two operations . . . standard cutting tool unit for boring bar.

●

Do you have the Wetmore Reamer Book, illustrating standard and special setups? Ask for Catalog 36A.

WETMORE REAMER COMPANY
418 North 27th Street, Dept. A
Milwaukee, Wisconsin

REAMERS and BORING BARS

The Jeep OF THE TOOL ROOM

. . . a tough little precision machine that keeps you from getting BOGGED DOWN . . .

Compact, simple in design and the versatility for quick change-over . . . that's why so many small but vitally important jobs can be scheduled for the Linley . . . the

HIGH-SPEED VERTICAL MILLING AND JIG BORING MACHINE

Eight spindle speeds, 275 to 4250 r.p.m. and direct micrometer setting, which eliminates the frequent errors of pencil figuring. Presents opportunities for handling a wide variety of die work, jig and model making, metal patterns, drilling, reaming, milling . . . quickly, accurately and economically.

Free your larger machines for all heavier work . . . Save time and power.

Bulletin sent on request.

LINLEY BROTHERS COMPANY

664 STATE STREET EXT., BRIDGEPORT, 1, CONN.

ERRINGTON

STAPLETON, STATEN ISLAND, N. Y.

MULTIPLE HEADS

Super-Sensitive Fixed Center Multiple Drilling Heads

Fixed-Center Auto-Reverse Multiple Tapping Heads

All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS . .

We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort.

We are also glad to announce our new product, Universal Mikrolok, the precision boring bar which can be quickly adjusted as easily as a micrometer to limits of .0005 or less. Write for catalog.

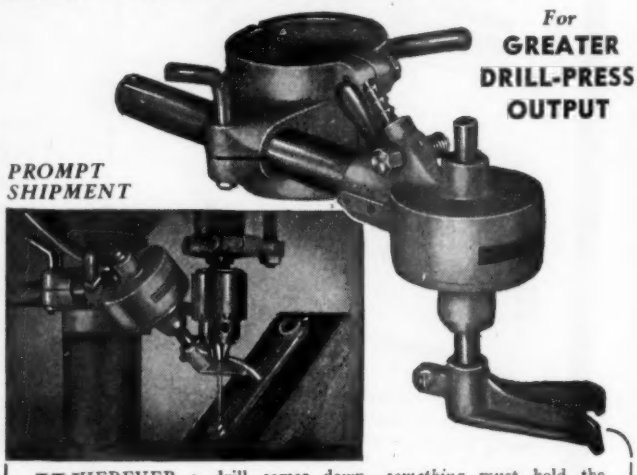
UNIVERSAL ENGINEERING CO.

FRANKENMUTH • MICHIGAN

NEW MEAD AIR-CLAMP

For **GREATER DRILL-PRESS OUTPUT**

PROMPT SHIPMENT



WHEREVER a drill comes down, *something* must hold the work. Wherever a drilling-jig is required, *Air-Clamp* will simplify it. Wherever *speed* is desired, *Air-Clamp* will produce it. *Air-Clamp* holds with relentless pressure; it is undisturbed by size variations (such as in castings), it scoffs at vibration (how many drills have been broken due to faulty holddowns?), chatter, snagging. *Air-Clamp* holds work of any size or shape in any position, at any angle. It can pay for itself on a single fixture; it can save its cost on a few days' drill-press output. It reduces operator fatigue. It saves hours and dollars in drafting-room, jig department, tool room and production line. *Air-Clamp* fits any drill-press having a cylindrical column. Special fixtures for Tee-slotted tables, light milling work, etc. Hand and/or foot control. Shipped on approval to responsible concerns.

FOOT AIR CONTROL READY!

For air-operated devices. Frees hands—speeds up work! Two types: Model "ON" releases work when pedal is pressed . . . Model "OFF" holds work when pedal is pressed. Low priced. Write!

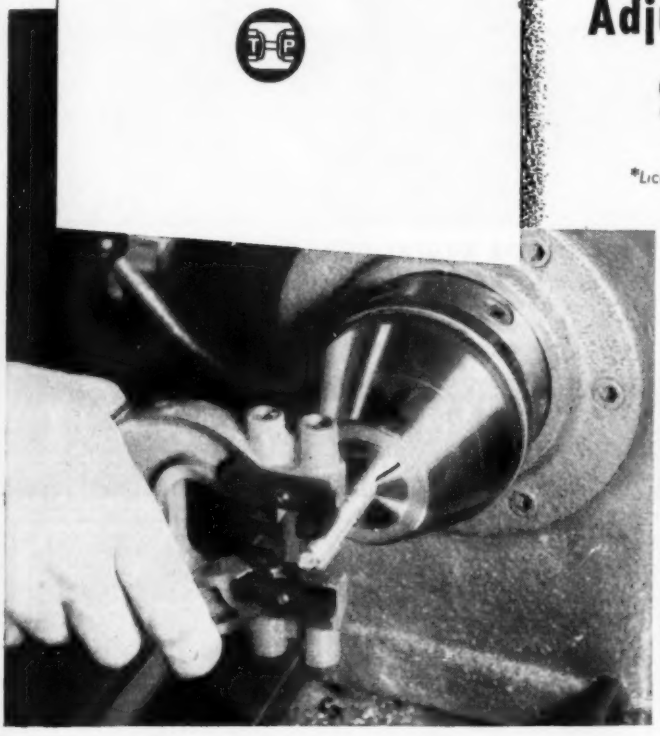
MEAD SPECIALTIES CO.

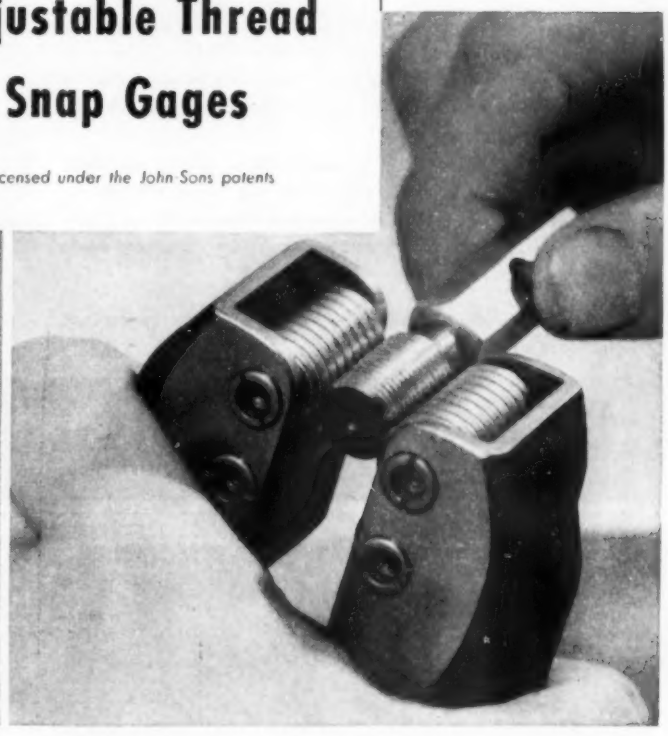
15 S. Market St., Dept. 83-MA, Chicago (6)

TAFT-PEIRCE *Announces*

A COMPLETE LINE OF Roll Thread* AND Adjustable Thread Snap Gages

*Licensed under the John Sons patents

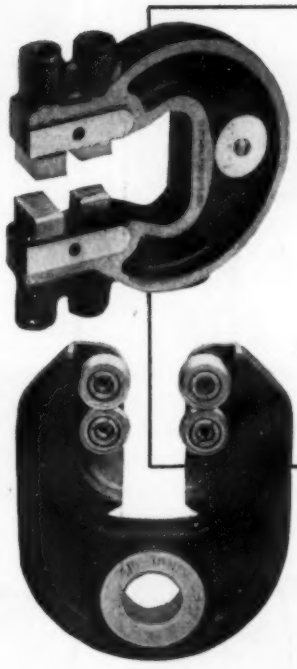




TAFT-PEIRCE is proud to announce the addition to its well-known Adjustable Thread Snap Gage line of a full line of *Roll* Thread Snap Gages, manufactured under the John-Sons patents. Thereby Taft-Peirce follows its established policy of providing a *complete* line of gages for every gaging preference and purpose.

The speed and convenience afforded by the use of thread snap gages for the external gaging of screw threads has established the soundness of the snap gage principle for the overwhelming majority of thread gaging applications. Each of the two well known types of thread snap gages—the roll thread type and the adjustable type—has its advantages and its own adherents. Both types have been proven through more than a decade of practical use in industry to be accurate and effective.

Taft-Peirce gage engineers are prepared to recommend the type best suited, in their judgment, to your problem, or will furnish either, according to your own preference. Write for new illustrated bulletin on the *complete* Taft-Peirce line of Thread Snap Gages.



Taft-Peirce Style 9432 Adjustable Thread Snap Gages, shown at left, and in use at left above, are available in sizes from ¼ to 4" in any pitch desired. This style of gage is adjustable over a range varying from ¼" to ½", depending on size.

Taft-Peirce Style 9435 Roll Thread Snap Gages are made in 2 styles. Shown in use, above right, is the closed-face type for general work. Directly at the left is the open-face type for use where the thread runs up to a shoulder.

The TAFT-PEIRCE

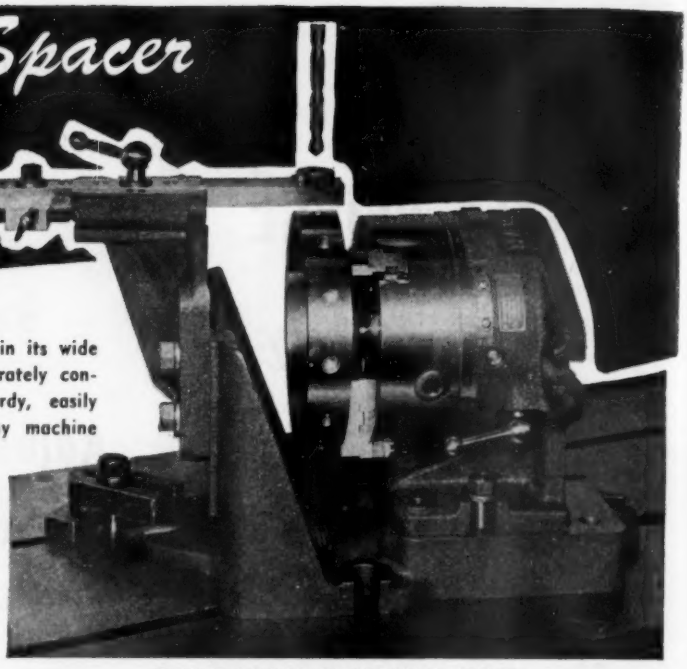
MANUFACTURING COMPANY

WOONSOCKET, RHODE ISLAND

THE *Hartford Super Spacer*

combines speed, accuracy and secure holding with

POSITIVE, FOOL-PROOF INDEXING



All machining operations within its wide scope of utility can be accurately controlled by this modern, sturdy, easily handled indexing device. Any machine operator can step up his (or her) production and maintain accuracy of work produced with the HARTFORD. Sturdy construction and secure holding make heavy cuts possible. Positive indexing with all chance of error eliminated is assured by the use of mask plates.

The Hartford Super-Spacer is applicable to drilling machines, millers, slotters, grinders, planers or jig borers. It can be used in either a vertical or horizontal position and is highly effective and economical for use on work involving single pieces or in quantity.

Send for complete details of the Hartford Super-Spacer and its many applications.

FOR RADIAL DRILLING, TOO

This "Hartford"-developed attachment—for use with the Super-Spacer—extends the application of this device to include radial drilling. It is easily attached and provides a means for taking care of variations in lengths and diameters.

THE HARTFORD SPECIAL MACHINERY COMPANY

HARTFORD CONNECTICUT

"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS . .

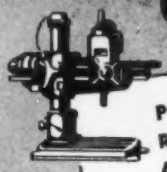
We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for America's war effort.

You can improve your production with Universal Collet Chucks which grip as strong as solid steel in both a radial and axial direction without marring the tool shank. Write for complete Collet Chuck catalog.

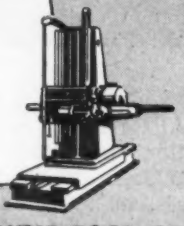
UNIVERSAL ENGINEERING CO.

FRANKENMUTH · MICHIGAN

GILBERT



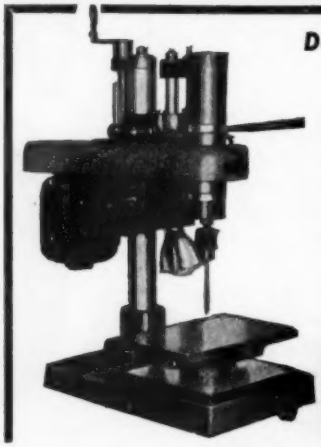
PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



DETAILS ON REQUEST

THE CINCINNATI GILBERT MACHINE TOOL CO.

CINCINNATI, OHIO



Do your sensitive drilling on a

MAXIE-JR-E

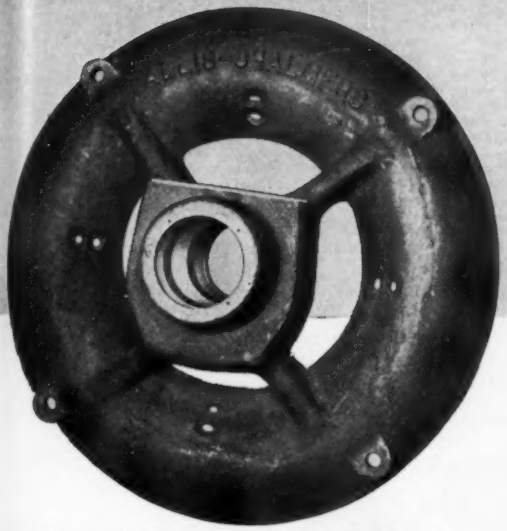
● Here is a high production unit for small holes from .004" to .250" diameter. Sturdy—smooth—fast—it is a self contained unit with 8 inch vertical adjustment on column. Drilling unit overhang from center of chuck to column 5". Vertical capacity 10". Available in spindle speeds from 750 to 12,000 r.p.m. Write for bulletin.

The Hamilton Tool Co.

HAMILTON OHIO

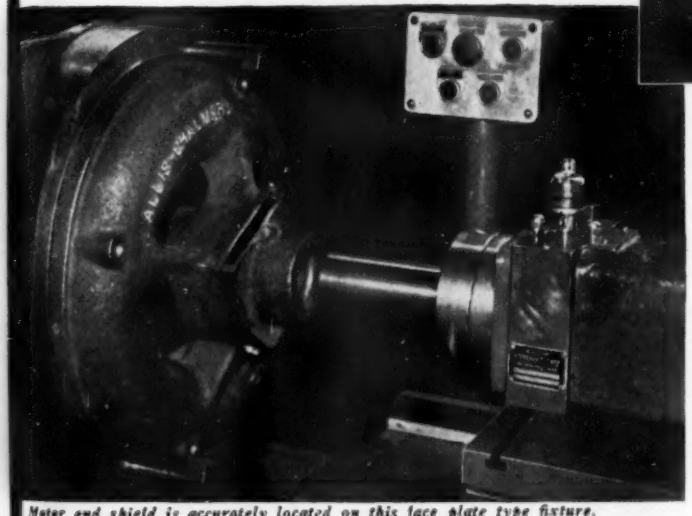
Motor End Shield Bearing Seats Precision Bored on

STOKERUNIT SIMPLEX *Precision* BORING MACHINE



The two bearing seats in this electric motor end shield are precision bored in one operation.

No. 2U Stokerunit Simplex Unit-Type Precision Boring Machines are adaptable to a wide range of work.



Motor end shield is accurately located on this face plate type fixture.

Finish Boring Time 2 Minutes for Both Seats . . . Total Boring Length—2¾″

The two bearing seats in the end shield of this electric motor are precision bored on a No. 2U Stokerunit Simplex Single-Spindle Precision Boring Machine. Both are identical in diameter—3.6875″. Length of bore on first seat is 1½″, on the second 1¼″. As they are spaced 4⅛″ apart, a total spindle travel of more than 6⅞″ is necessary to complete the boring operation.

The total boring time of only 2 minutes for both bearing seats is made possible by rapid traverse of the Stokerunit Simplex spindle unit, which automatically provides quick approach to cutting position at each seat and quick return at end of machining cycle.

Additional Boring Data: Spindle speed 400 r.p.m.; feed 1⅜″ per min. Tolerance on finish bore is −.001″; high finish is produced. Material is cast iron. Tungsten carbide cutters are used.

The face plate type locating fixture has multiple locating rabbets for holding various sizes of end shields. This fixture is also equipped with an adapter for holding various sizes of ball bearing cages up to 6″ in diameter while boring the ball bearing seats.

Profit with Stokerunit Versatility...

Over 25 versatile models of Stokerunit Simplex Precision Boring Machines are available to solve *your* precision boring problems. They cover practically the entire range of precision boring applications and can be furnished in mechanical and hydraulic feeds, with single or multiple spindles, for either short-run or production work.

For specific recommendations, send blueprints of parts with production requirements. No obligation.

Write Today for these two booklets covering details of our entire line of Simplex Precision Boring Machines.

STOKERUNIT CORPORATION

DESIGNERS AND BUILDERS OF PRECISION BORING MACHINES AND MILLING MACHINES

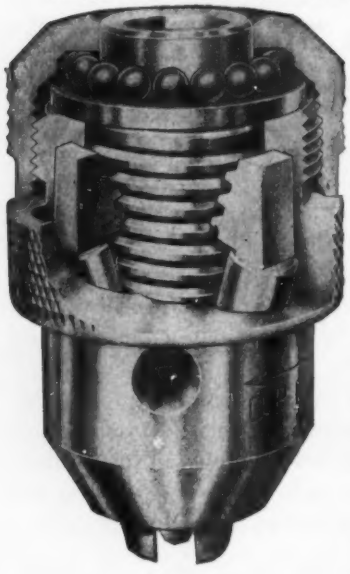
4524 WEST MITCHELL STREET • MILWAUKEE 14, WISCONSIN

Ettco-Emrick KEYLESS DRILL CHUCKS

5 SIZES
for No. 0
to 5/8" drills

are more than just drill holders . . . they're production boosters

It's the keyless, self-tightening feature that does it. Stop and consider how much time and energy is used up in the course of a day's drilling by the non-productive key-tightening operation, and you realize how important is the advantage of Ettco-Emrick Chucks in eliminating the key.



These keyless drill chucks are particularly desirable for women operators because no strength is required to set up drills. Drilling action does the tightening — and the heavier the load the tighter the grip. This saves more time because retightening is never necessary. Yet the design makes it just as easy to loosen them up by hand.

You are also assured of years of hard, trouble-free service from Ettco-Emrick Chucks because they are built to the highest standards of precision tool quality.

BULLETIN No. 6
gives full details. Copy mailed on request. Write for one—today.

ETTCO TOOL CO.

590 Johnson Ave., Brooklyn 6, N. Y.
Detroit • Chicago

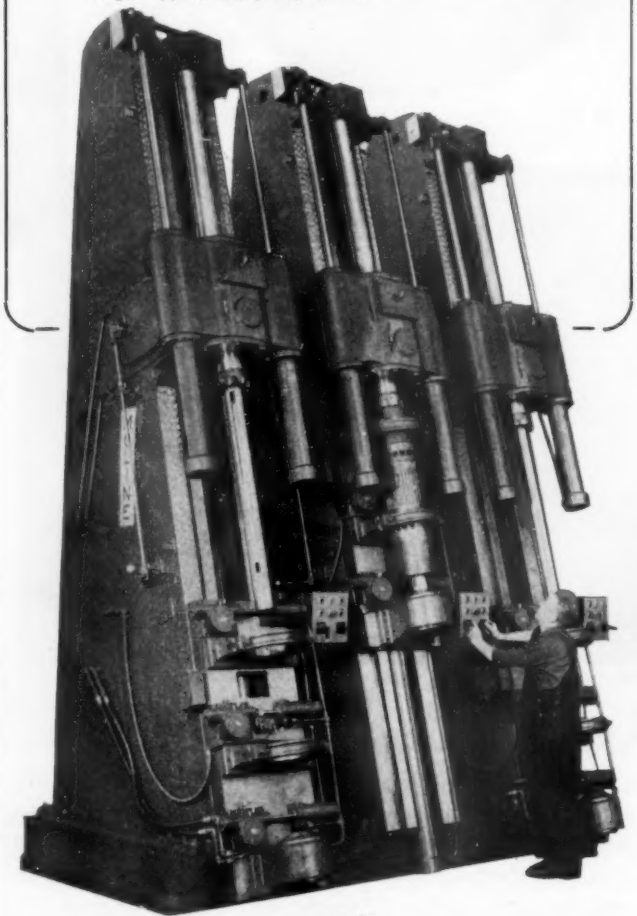
The famous Ettco-Emrick
DRILL CHUCKS • TAP HOLDING CHUCKS
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

3 of a kind

Bore and Face Giant Diesel Cylinder Sleeves

Here is MOLINE'S answer to a large Diesel engine builder's problem — a special boring machine heavy and rigid enough to accurately bore and face ends of large diameter cylinder sleeves. Illustrated below are three MR-114 Boring Machines, tied together to form one 3-column unit, but each of the three is operated independently. Each consists of a heavy, rigid column with a Boring Spindle Thrust Bearing Assembly and a Work Holding Fixture movable on its inclined ways. Each unit has 2 motors, one to drive the spindle, the other to drive a hydraulic feed mechanism. A shift lever gives 2 rotational speeds for the spindle. The boring tool is piloted below the work. The fixture is set at the extreme "down" position for loading, the extreme "up" position for boring, and at an intermediate location which permits the operator to watch the facing operation.

All functions of the machine are controlled by a combination of push buttons and selector switches, and electrical interlocking prevents possible errors in operating sequence. Automatic lubrication of ways and spindle drive gears assures freedom from troubles occasioned by oversight where manual lubrication is used. The three column unit illustrated covers a floor area 8'4" x 11'7", has an overall height of 17'9" and weighs approximately 77,200 lbs.



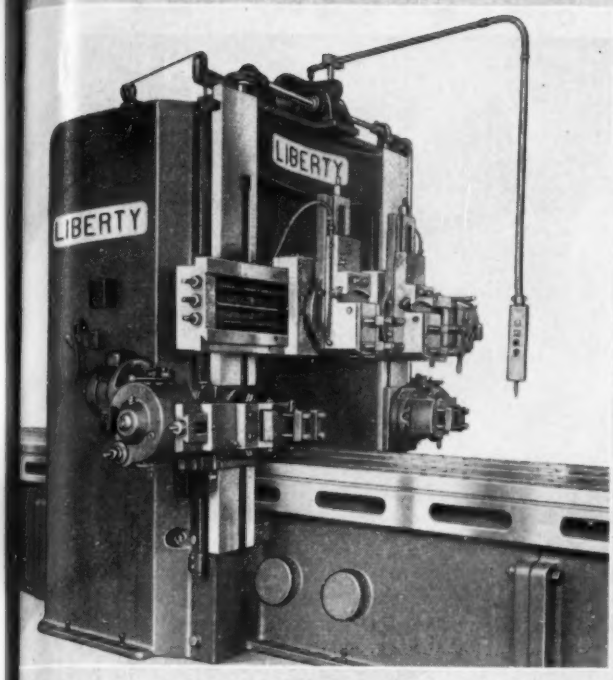
MOLINE TOOL CO.
"HOLE-HOG"
MOLINE, ILLINOIS

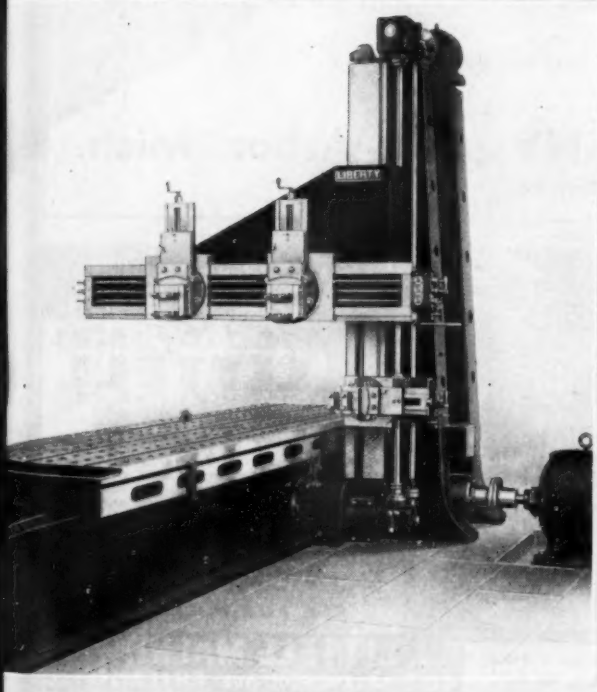
Since 1901

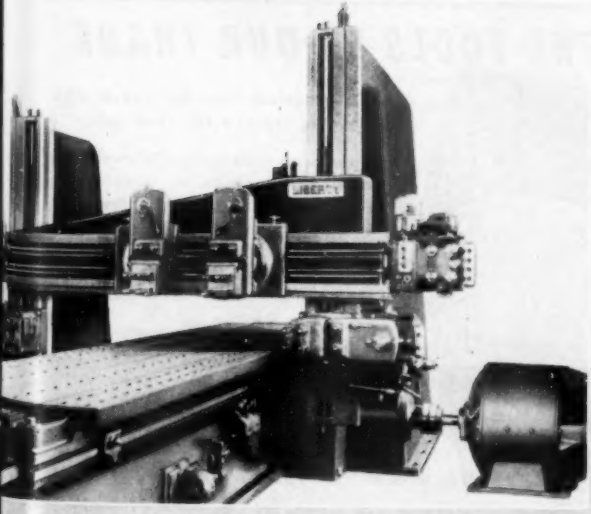
Builders of Special Machinery for Drilling, Boring, Honing and Tapping

LIBERTY PLANERS

A size and type for every planer job







MEDIUM DUTY 48" x 48" DOUBLE HOUSING PLANER

This new Liberty incorporates many modern features of design and construction that make for accuracy, efficiency and economy on medium class planer work. Double length bed . . . pressure lubricated Vees . . . box type table with "T" slots machined from the solid . . . deep box type cross rails individually motorized for elevating are a few of the features of this modern planer.

STANDARD DESIGN OPEN SIDE PLANERS

The Liberty Standard Open Side Planers are extremely simple in design and construction to provide particular ease of operation. The feed is a decided improvement over old arrangements. The operator can control the feed on rail heads without stopping the machine. Amount of feed is indicated by dial, enabling the operator to set feed to suit requirements. Position of handles indicate direction of feed.

HEAVY DUTY CONVERTIBLE PLANER

This Liberty Convertible Planer combines versatility of the Open Side with the rigidity of the Double Housing Planer. On the four head machine, the range of side heads is increased due to movement of left hand housing which permits the use of side heads on much narrower work than is possible on a double housing machine of similar capacity.

All of these Liberty Planers are now serving on all types of war work in plants all over the country—tomorrow they will be ready for those jobs on which costs are of prime importance to meet competitive conditions.

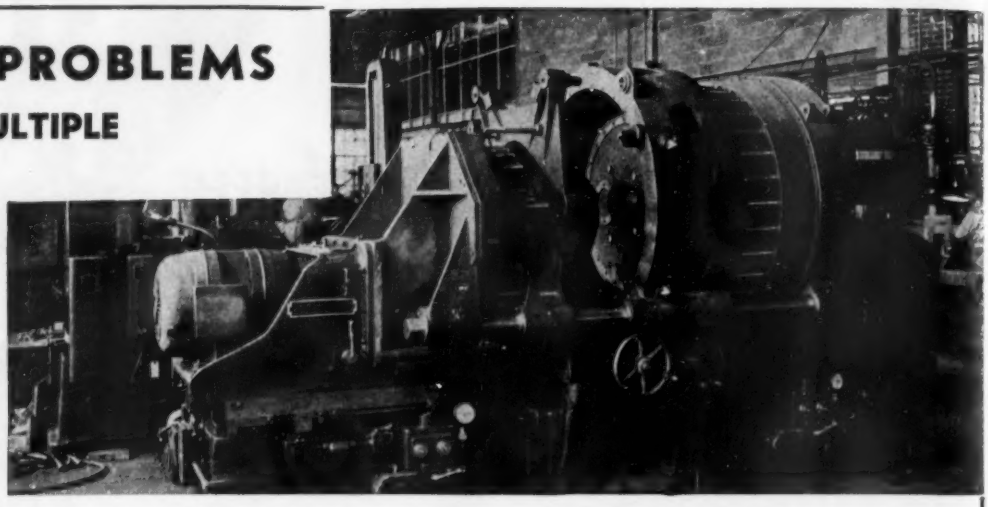
Consult Liberty on your Planer work

LIBERTY PLANERS

HAMILTON . . . OHIO

SOLVING PROBLEMS INVOLVING MULTIPLE SPINDLE OPERATIONS A Buhr SPECIALTY

Note This One



Tooling consists of a fixture for clamping an anti-aircraft part of which one side is a bushing plate. Right hand head has 82-spindles, and Left hand head has 38 spindles with a sliding bushing plate for removal of part from fixture.

All spindles have vertical adjustment for drill adjustment. An oil pump is provided in each head to insure positive lubrication to all ball bearings in the head.

These heads are direct motor driven and mounted on ways and are moved in and out by hydraulic cylinders.

If you have a production problem, let Buhr engineers help you.

BUHR MACHINE TOOL COMPANY, Ann Arbor, Mich.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

The
"HOUSE OF PRECISION"
★
Jansson Gage Blocks—a good standard for precision measurement. Used by leading armaments manufacturers. Preferred by experienced inspectors for their extreme accuracy.
★
JANSSON
GAGE COMPANY
DETROIT • MICHIGAN

Write for Literature and Prices

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Coil Stock
feed it faster
with LITTELL
AUTOMATIC CENTERING
REELS
WAR production is rolling along faster where coil stock is uncoiled with LITTELL Automatic Centering Reels. They insure a free-flowing loss of material. Coil capacities up to 20,000 lbs.
Littell also makes a complete line of other press-room equipment—Roll, Dial, Magazine and Hopper Feeds—Straightening Machines, Air Blast Valves, Pres-Vac Safety Feeders, etc.
ASK FOR BULLETINS
Littell No. 5 Reel. Capacity 500 lbs.
F.J. LITTELL MACHINE CO
4169 RAVENSWOOD AVE CHICAGO ILL.

"THE TOOLS OF OUR TRADE"

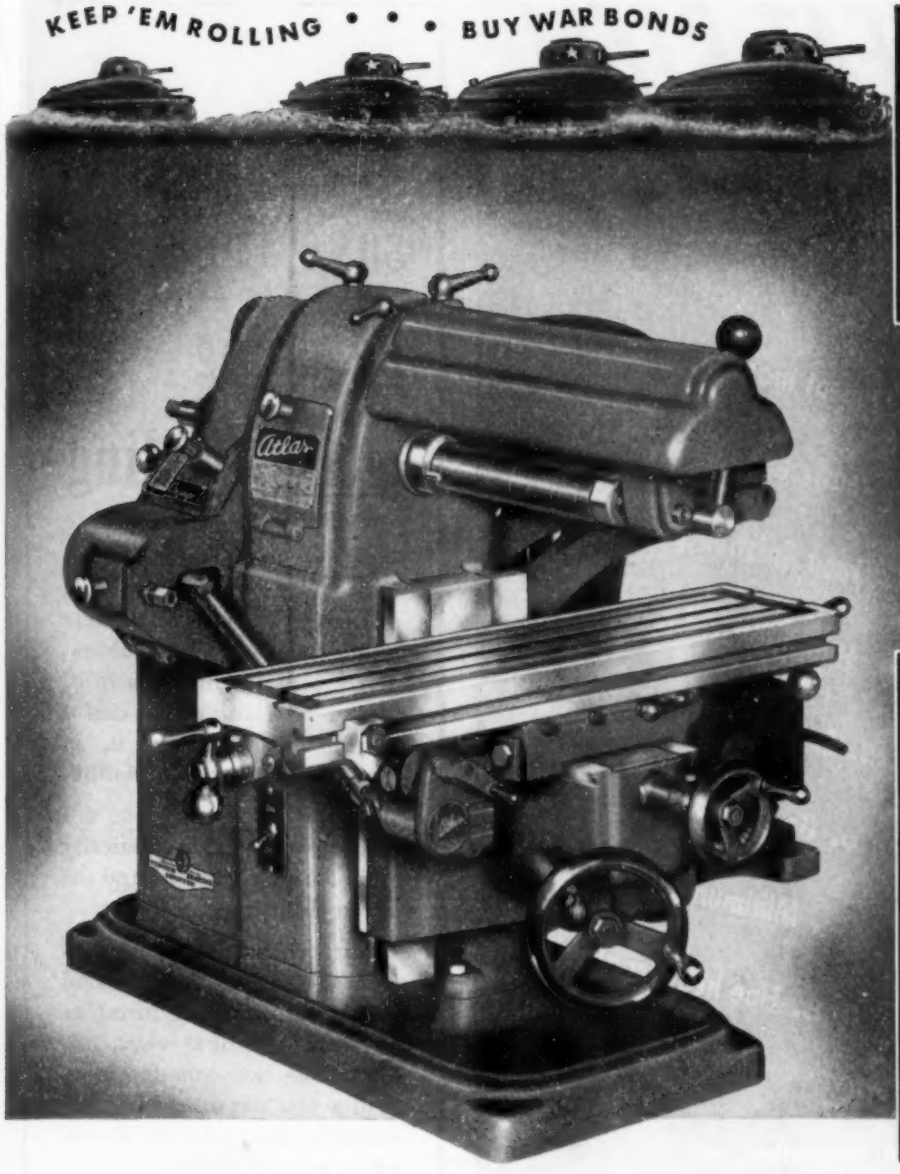
Here's practical help for those who must be trained for shop jobs

● Sixteen pages of basic shop information — a word-and-picture book of common machine shop tools and their uses. Just what the novice needs to know to get started fast. Management is finding "Tools of Our Trade" extremely helpful in training new employees. Reprints available now — write today.

Price — 10¢ per copy

AMERICAN MACHINIST 330 W. 42nd Street, New York 18, N. Y.

KEEP 'EM ROLLING • • • BUY WAR BONDS



Atlas BENCH MILLING MACHINE

CONDENSED SPECIFICATIONS

Table	4½" x 18"
Table Travel	
Longitudinal	10"
Vertical	6"
No. of Spindle Speeds	12
Speed Range	61 to 2860 RPM
Overall	25½" x 32½" x 22"
Motor	1/3 HP 1740 RPM

Complete V-belt drive, quick-change countershaft, precision-ground table. Three types of table controls: hand-operated, rapid production lever and Atlas "Change-O-Matic" for instant selection of reversible automatic feeds.

"MATCH THE MACHINE TO THE JOB"

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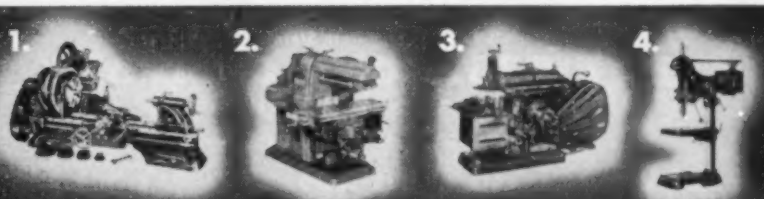

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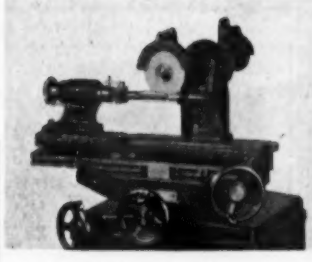
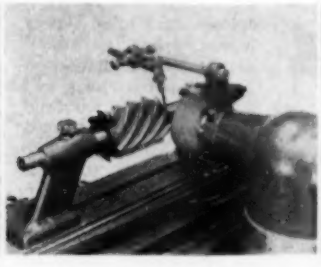
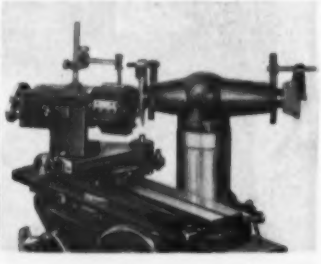


Tap Grinding Attachment



Sharpening Helical Cutter



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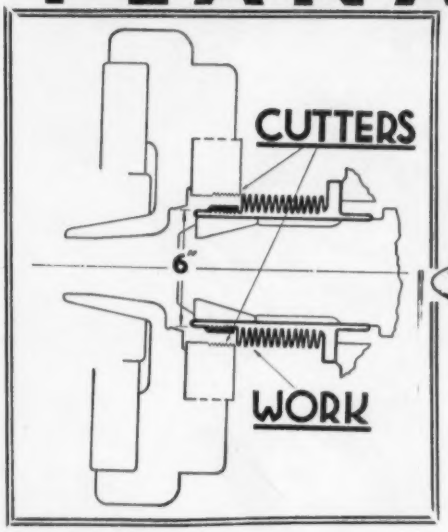

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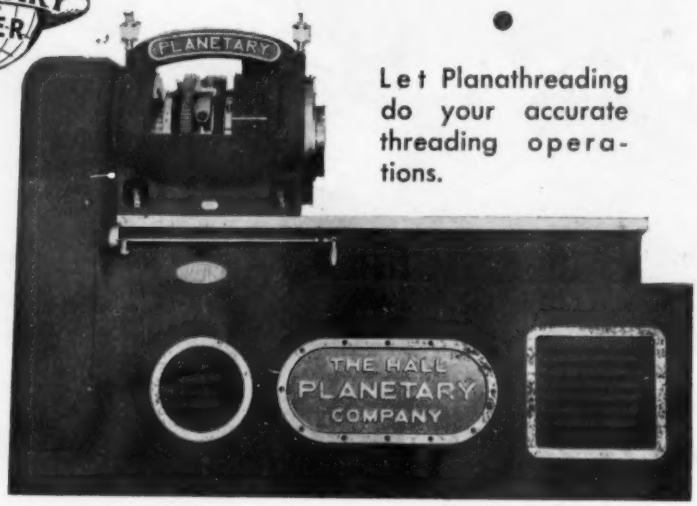

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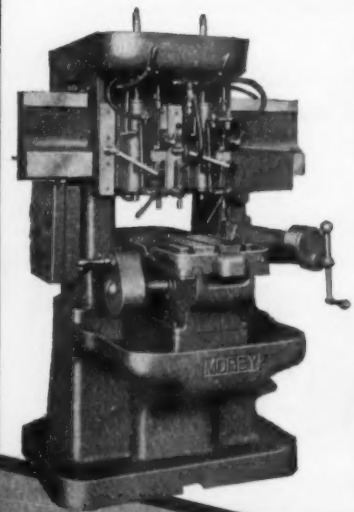

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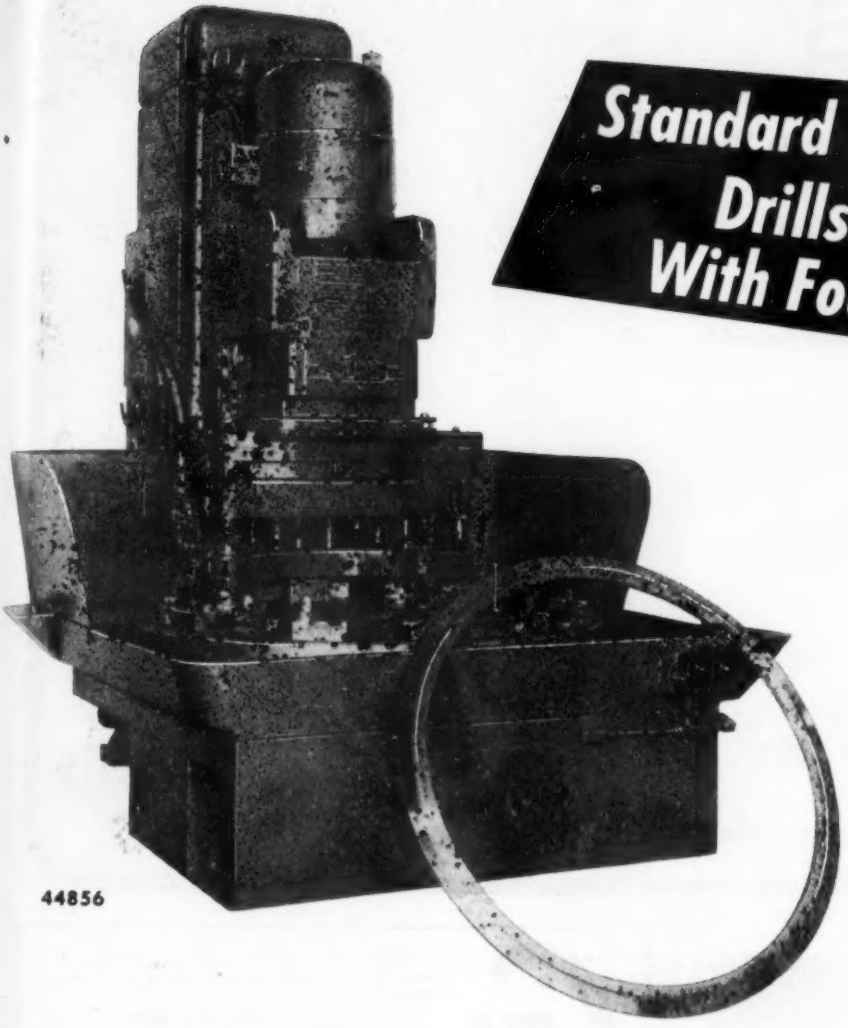

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IN this operation, a standard Snyder 20 V 16 Hydraulic Drilling and Boring Machine is used to drill 56 holes in a large diameter locating ring which is a tank destroyer part.

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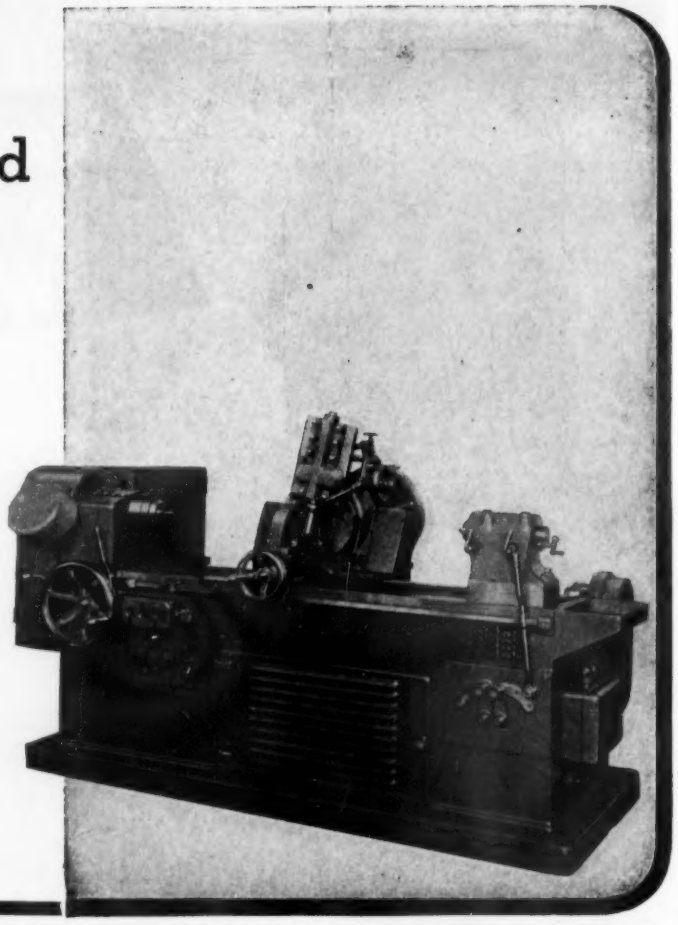

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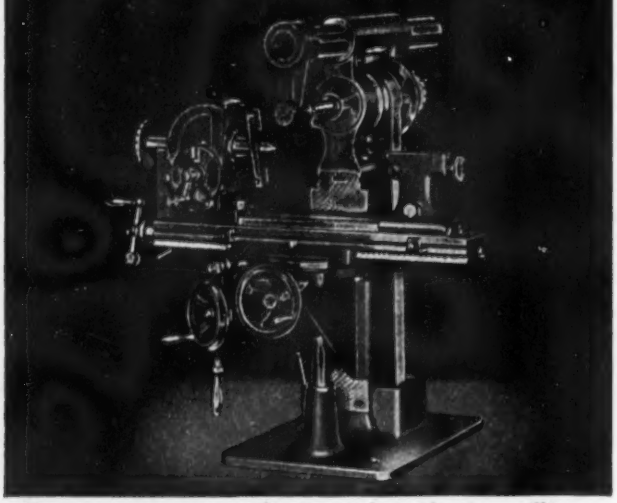

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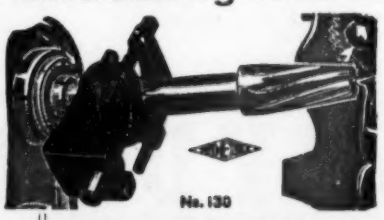

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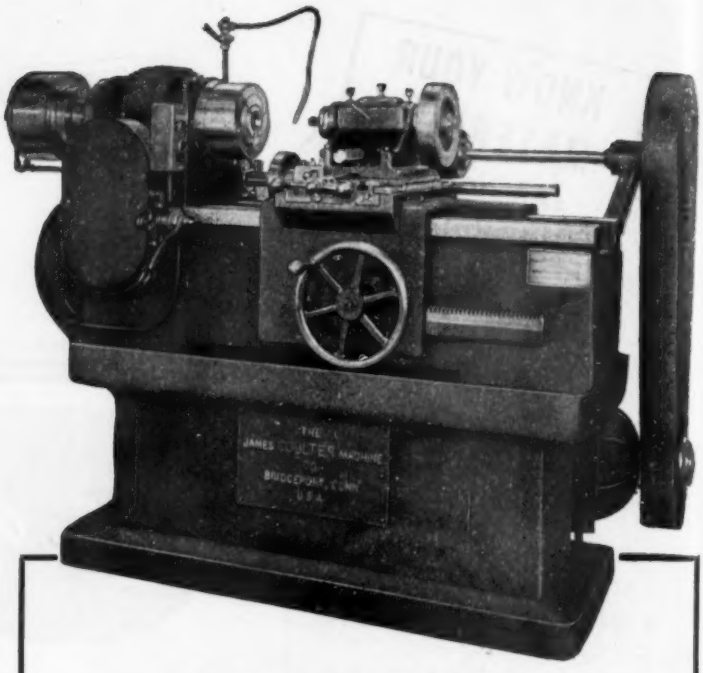

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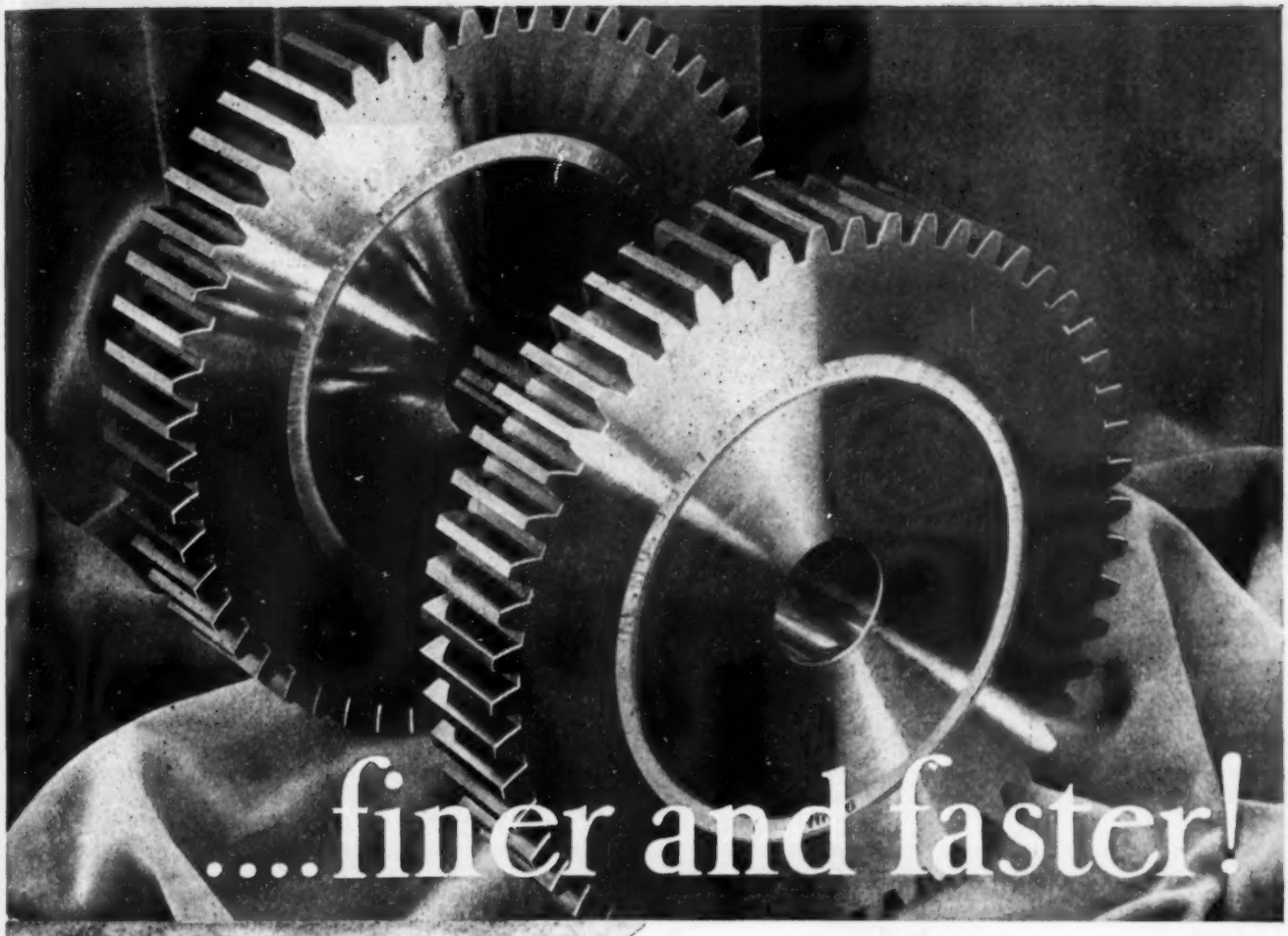

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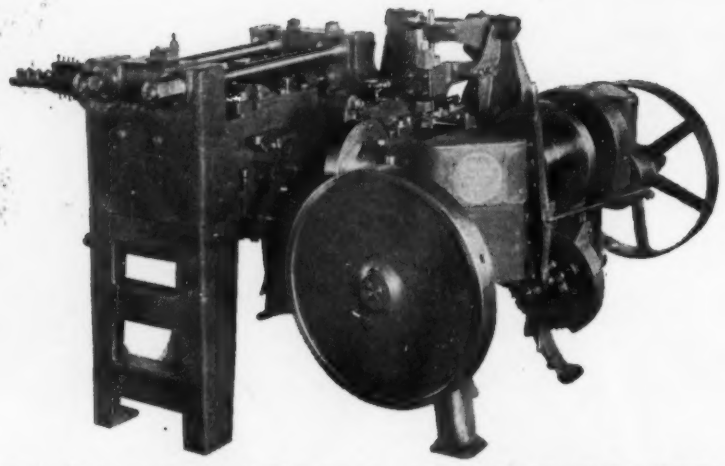

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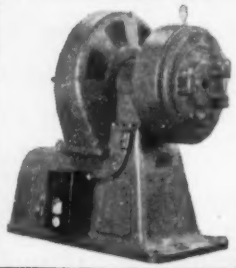

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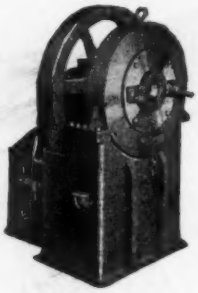

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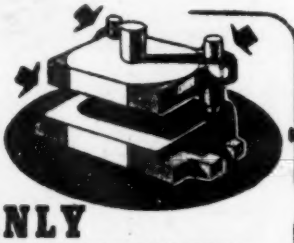

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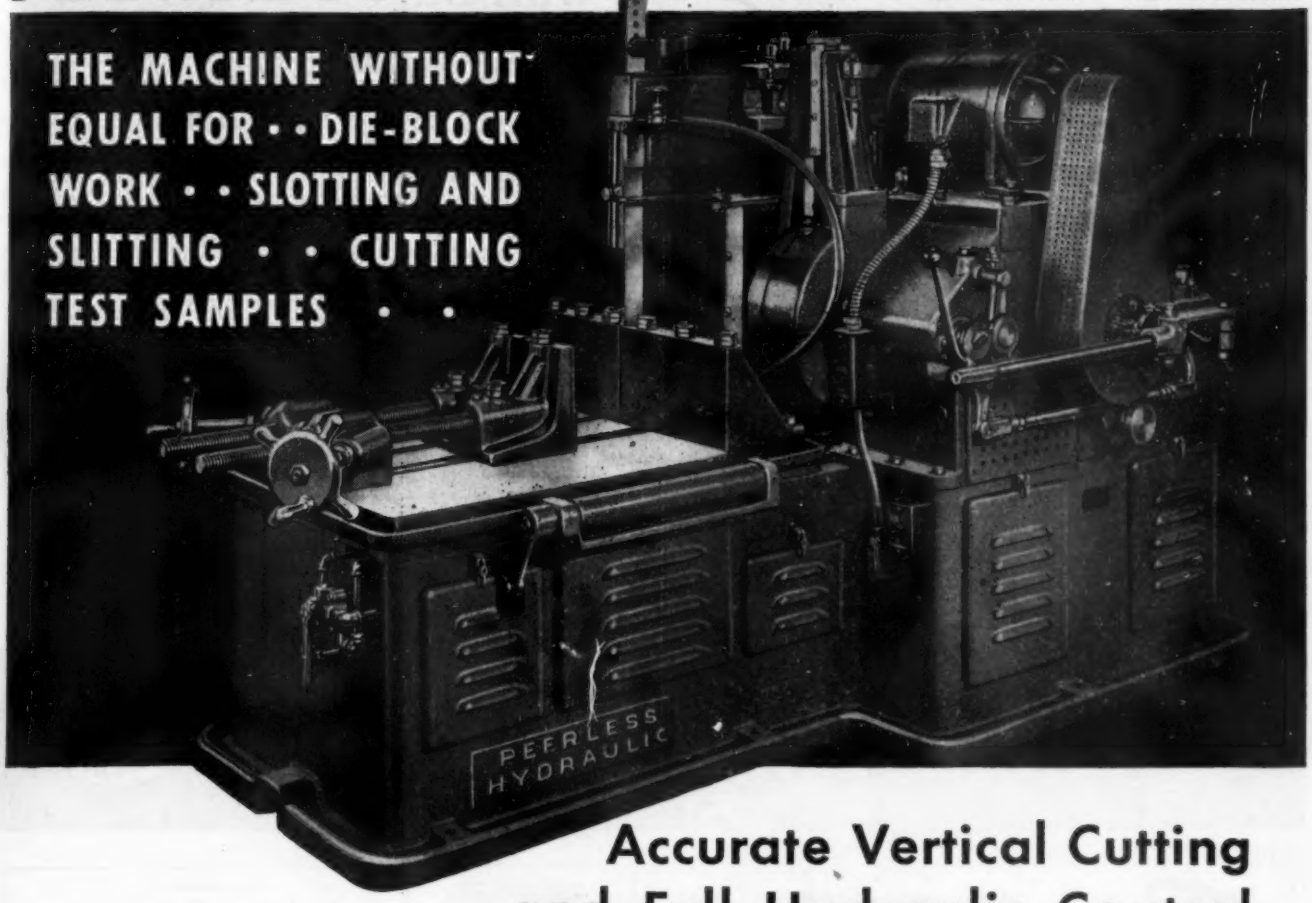

Accurate Vertical Cutting and Full Hydraulic Control

For sawing valuable tool stock, this Peerless VERTICAL is highly profitable to tool and die manufacturers. The large, squarely cut scrap pieces are usable for smaller dies, strippers and stripper plates. Steel mills use Peerless Verticals for cutting test samples from billets. Extension of the working table to 35 in. permits loading by crane. Tool steel 24 in. long and up to 10 in. wide can be sawed through without turning the work.

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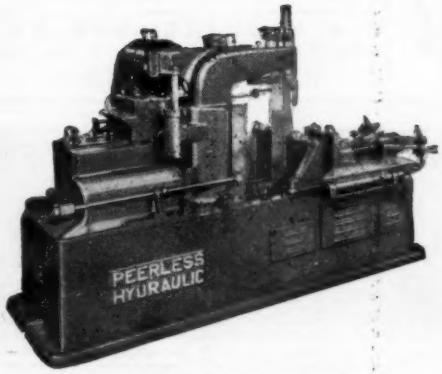

The Massive High-Duty Peerless Vertical Cuts 10 x 24-in. Tool Stock Without Turning the Work.

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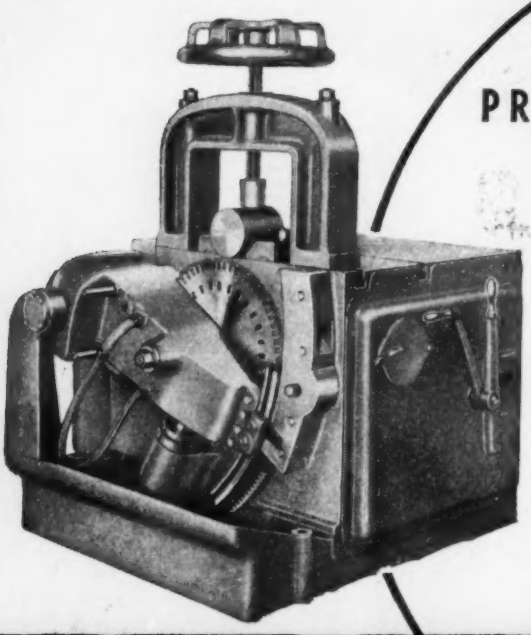

This new 8" machine will step-up production and make such big returns in time and money savings in cutting stock for 3 inches up as to quickly return its first cost.

Here's the machine to break bottlenecks in cold metal sawing—a machine that's versatile, fast, powerful and accurate, yet easy to control and economical to operate. You can put it to work on single pieces or by nesting of bars or shapes, handle multiple unit cutting up to the capacity of the machine.

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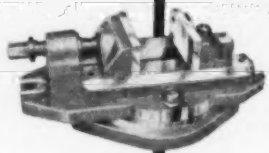
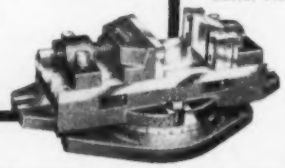

4½" Swivel Vise for tool rooms and machine shops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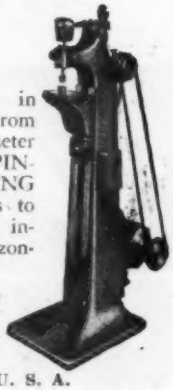

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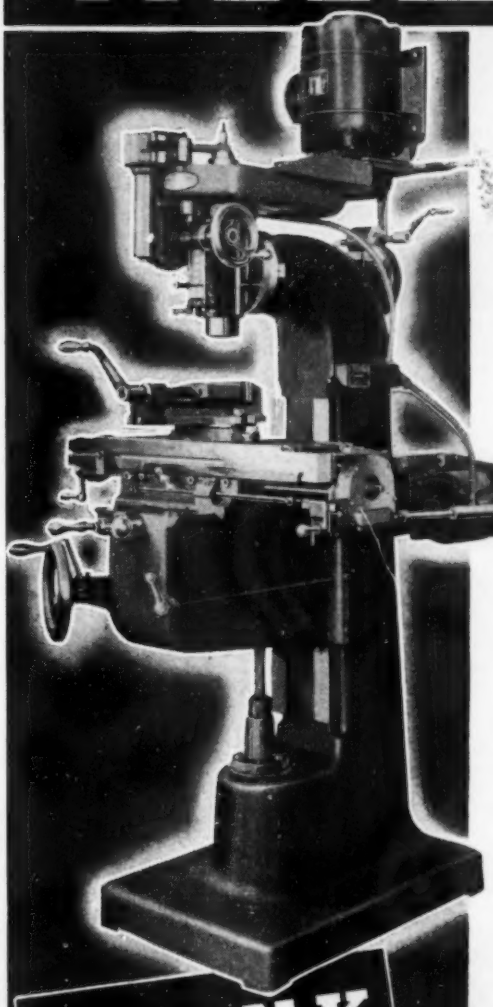

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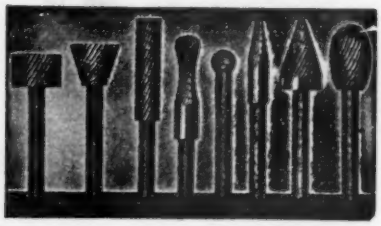

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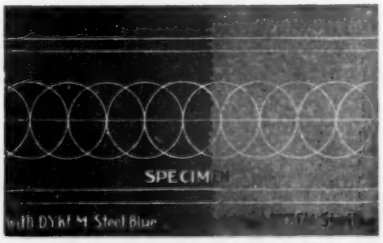

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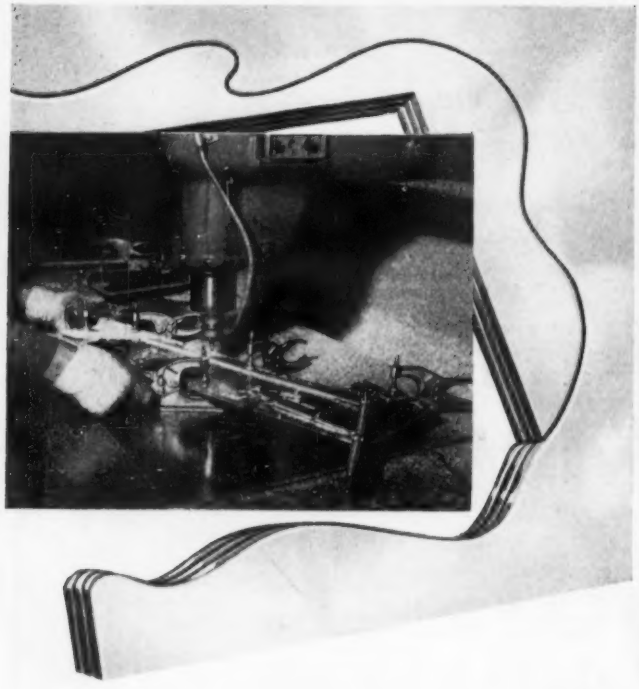

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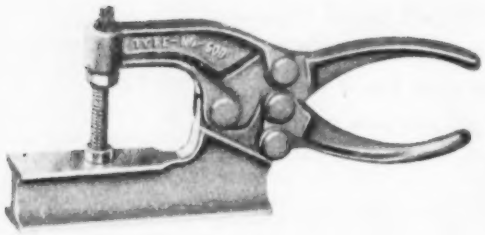
MODEL KL-500



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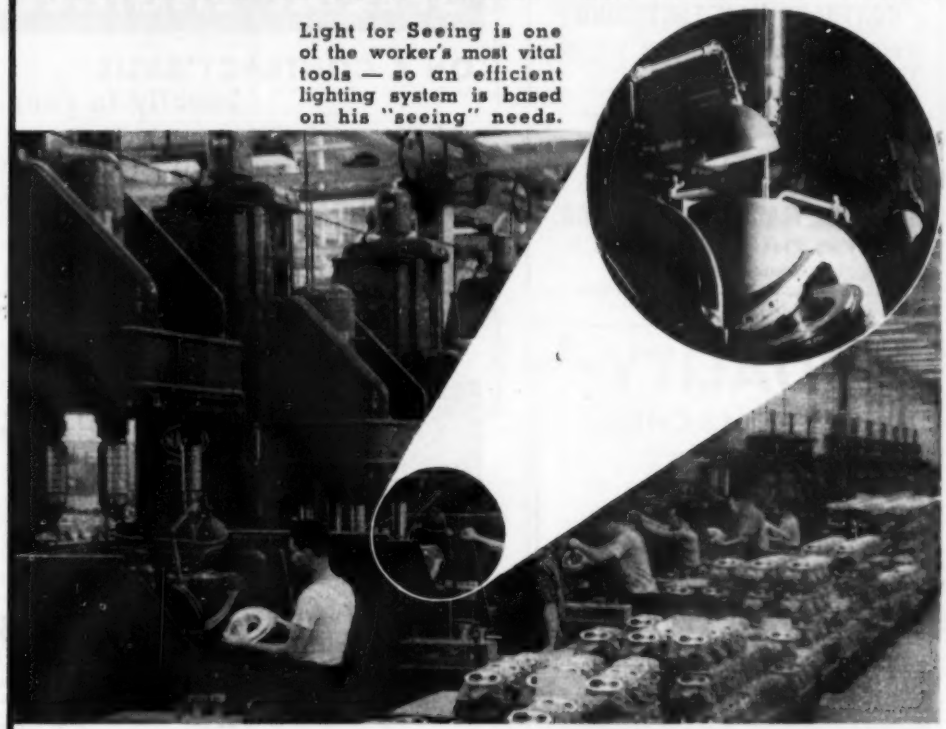

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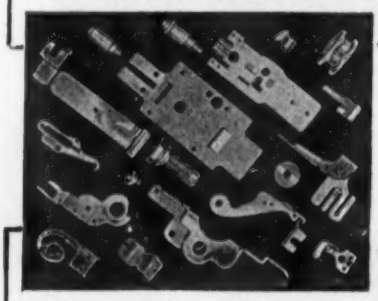

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NEW ADVERTISEMENTS received by 10 A.M., August 6th will appear in the issue of August 19th subject to limitations of space available

WANTED — DEVELOPMENT ENGINEERS

Mechanical engineers with product development background for both war and post-war development work. Also need several capable men as project engineers. Permanent positions.

P631 American Machinist
520 North Michigan Ave., Chicago 11, Ill.

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

MECHANICAL DRAFTSMAN with practical mechanical experience in blanking, drawing and forming dies for sheet aluminum products in defense plant in Midwest; give experience and full particulars. P-593, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

TOOL MAKERS for defense plant in Midwest; give experience and full particulars. P-594, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER, to carry-on, direct and expedite the development of new Mechanical Processes, Tooling and Electric Powered Machines and equipment. P-607, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WANTED: Good experienced Machine tool designer. Splendid opportunity now and after war with old established machine tool builder. P-625, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WANTED: Man with machine tool experience necessary. Must be draft deferred. State technical qualifications. Requires traveling. Essential industry. P-633. American Machinist, 330 W. 42d St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

TO EMPLOYERS WHO ADVERTISE FOR MEN . . .

The answers you receive to your advertisements are sent with the hope of securing the position offered. If only the most promising letters are acknowledged—the other applicants never know whether their letters reached a prospective employer, or not—and sometimes question their bona fide character. We guarantee that every advertisement printed in the Searchlight Section is authorized.

You can help keep our readers interested—and get better returns to future advertising in this section—if you acknowledge each reply.

Departmental Staff—American Machinist

"Put yourself in his place."

WANTED

Powder Metallurgist—Laboratory Technician

Excellent opportunity with new division of established midwestern concern. To be in charge of research and production of custom fabricated parts.

MIDLAND DIE & ENGRAVING CO.
1800 W. Berenice Chicago, Illinois

WANTED

SALESMAN — DISTRICT MANAGER

for Chicago Office by Manufacturer of Taps, Tool Bits and Small Tools

SW630 American Machinist
520 North Michigan Ave., Chicago 11, Ill.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY WANTED

SALES REPRESENTATIVE for state of NEW JERSEY. One or two non-competitive accounts wanted in metal-working machinery or accessories. Established office and contacts. Graduate engineer competent and experienced in technical service-sales. SA-611, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Ollwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED—For advertisements of work wanted see page 294.

WANTED

ANYTHING within reason that is wanted in the field served by American Machinist can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

PROFESSIONAL SERVICES

Engineering and Research Co.

MACHINE DESIGNERS
MECHANICAL ENGINEERS

High Production Dies, Tools, Jigs and Fixtures, Methods, Job Analysis, Consultants and Supervisors, Industrial Engineering and Research

Chatham Phenix Building, 29-28 41st Ave., Long Island City, New York

—CAN *YOUR* PLANT DO—

CLOSE TOLERANCE CONTRACT WORK?

Facilities desired for production of miniature gas motors. Modern shop with record for precision workmanship and pride in its output. East preferred.

EQUIPMENT REQUIRED

MILLERS LIGHT POWER PRESS
AUTOMATIC & SECONDARY "SURFACE"
SCREW MACHINES (to 2")
CYLINDRICAL & "SURFACE" GRINDERS
LAPPING MACHINERY & MAGNESIUM
DIE CASTING EQUIPMENT DESIRABLE

Tools, Dies & Jigs Available. Interesting Volume.

Write fully, arranging for inspection appointment of your plant.

CW-629, AMERICAN MACHINIST
330 W. 42nd Street New York 18, N. Y.

WANTED

WANTED

PNEUMATIC SCALE
PACKAGING EQUIPMENT

Pneumatic Scale carton packaging equipment consisting of carton feeders, bottom sealers, small or medium liners, scales and top sealers. Units must be in good condition and either the 30 per minute or 60 per minute lines will be suitable. Reply Box W-632, American Machinist, 330 West 42nd Street, New York 18, N. Y.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

POST WAR PRODUCT

Wanted for purchase or manufacture, by a completely equipped manufacturing plant, which has an excellent sales organization. Write us giving details of your product or item.

BO 627, American Machinist
330 West 42nd St., New York 18, N. Y.

LEFT: *Building up a worn steel crankshaft.* BELOW: *A skilled mechanic develops a perfect bearing on the surface of a turret head's ways by hand scraping.*

a war production

MUST:

ENGINEERED REBUILDING

keeps machine tools running!

The Arsenal of Democracy is now tooled up and producing for all it's worth. From here on in...*existing* plants and machine tools must turn out the matériel for final victory. "Making the most of what we have," as a result, becomes the order of the day, and Simmons is prepared, as it has been ever since this war first threatened, to help metal-working industries over their machine tool obstacles by *Engineered Rebuilding.* • Today more than ever, when machine tools break down they must be speedily and efficiently rebuilt. Simmons has the experience and facilities to solve your rebuilding problem quickly. Ask today for full details. Simmons Machine Tool Corporation, 1759 North Broadway, Albany 1, N. Y.

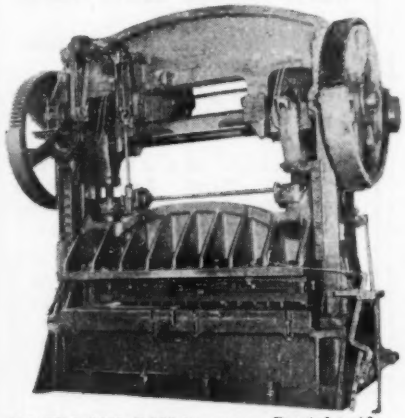
SIMMONS ENGINEERED *Machine Tool* REBUILDING

Amer. Mach. 1009

IN STOCK!!!

"FALK" for DEPENDABILITY in Rebuilt Machinery

Toledo 94½-J 200 Ton Press



TOLEDO 94½-J 200 ton press. Straight side, tie rod, double twin, direct geared M.D. with 30 H.P. 3 ph. 60 cy. 440 V. motor & con. Forced feed lub., pneumatic controlled friction clutch & brakes. Bed area —120" right to left x 50" front to back. 12" stroke, 18" shee height. Bed equipped with spring cushions. Weight approx. 80,000 lbs.

Sanford No. 1½ Production Miller, Rotary Table.

Cleveland Vertical Miller No. 1 (New.)

Shapers and Slotters

26" Cincinnati Triple Geared Shaper, Friction Drive.

20" x 20" x 36" N-B-P Shaper-Planer, Arranged Motor Drive.

12" New Haven Slotter.

16" Kelly Back Geared Crank Shaper, cone drive.

17" Smith Mills B. G. Crank, cone drive.

Presses, Brakes and Shears

MARIETTA Power Press Brake 104" between uprights. Dual rams to permit operations on separate dies from both sides of press. Bed area 20" x 104", each rame 6¼" x 98". 4" crank shaft, 3" stroke. Excellent condition.

No. 306 Bliss Straight Side, Tie Rod, 8" stroke, air cushion, motor drive, Press.

No. 65 N Bliss Straight Side, Tie Rod, Geared, 125 ton, 6" stroke, air cushion, motor drive, Press.

No. 3½C Bliss Toggle Press, Tie Rod, Vee belt motors.

No. 3½C Bliss Toggle Press, Solid Frame, Vee belt Motor Drive.

No. 3 A Bliss Toggle Press, 5½" shaft, Vee belt Motor Drive.

¼" Cone Automatic Cut Off

This machine is primarily for cutting off bar stock, or tubing. Can be arranged for light forming, chamfering and drilling. Size 1¼" round, 1 5/64 hex; ¾ sq. max. feed 12" wt. 10,000 lb. with 15 H.P. motor.

TURRET LATHES

21"Gisholt Universal Turret Lathe with 3¾" hole in spindle, 2-step cone for 5" belt.

Jones & Lamson 3x36 Double Spindle, air chuck equipment.

Jones & Lamson 3 x 36 Single Spindle, Geared Head, Single Pulley Drive.

2—LeBlond 9"x16" Multi Cut Automatic Lathes, motor dr. has back facing attachments.

STRAIGHTENING MACHINE

No. 5-18½ Littell Single Rack & Pinion Feeding and Straightening Machine.

RADIAL DRILLS

2—Niles-Bement-Pond, box column 5' arm.

1—Niles-Bement-Pond, box column 6' arm.

GRINDERS

No. 6 Besley Double Opposed Disc Grinder.

No. 2 and No. 3 Brown & Sharpe Cutter Grinder.

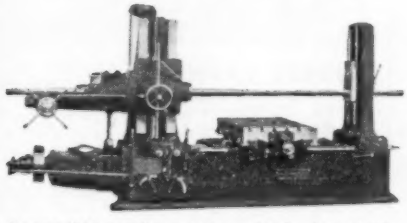
Badger No. 2 Double End Disc Grinder 16" disc, ball bearing spindle, Universal table.

Gorton, double end Disc Grinder, 18" discs.

Greenfield No. 12, Hydraulic Feed, motor drive; cap. swings 15", Grinds automatically ¾" to 5" di., 4" deep, New in 1928.

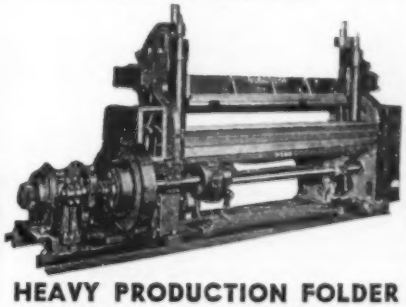
#32 LUCAS "PRECISION"

Boring—Drilling and Milling



Lucas #32 precision horizontal boring, drilling, and milling machine, 3¾" Bar. Extra length bed and table. Silent chain motor drive. 7½ H.P. G.E. 3 ph., 60 cy., 440 v' Push button control. Fully Guaranteed.

#98 NIAGARA

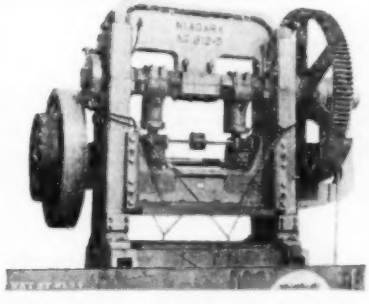


HEAVY PRODUCTION FOLDER

6' x 14 gauge capacity. Ar. M.D.

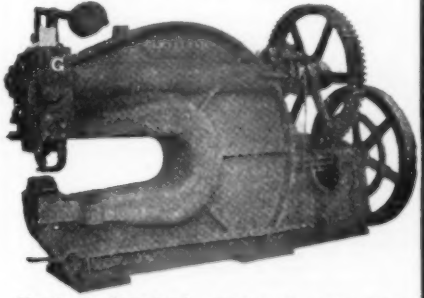
Working length 72", cap. 14 gauge; min. width of fold at cap. 1" gaging range (narrow folds) ¾" to 1¾", max. gaging range 72" left of chamfering bar 3". Shipping wt. 12,690 lbs. Like new.

200 TON NIAGARA



1—Niagara #612 D press. Straight side, double crank, back geared, 200 ton cap., 3" stroke, bed 60 x 38.

MODEL G CLEVELAND GAP PUNCH



Vertical Cleveland, model G open Gap Punch. 52" throat, arch Jaw, 2" hole thru 1" plate cap. arrange for Gear motor drive. 10 H.P., 3 ph., 60 cy., 220 v.

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MACHINERY

Tel. Main 6347

FALK

MACHINERY CO.,

18 WARD ST.

MERCHANTS

ROCHESTER 5, N. Y.

EASTERN OFFERS FROM STOCK

AUTOMATICS

4 spindle ⅞" Cleveland Model M, m.d.
2¼" Gridley Single Spindle Automatic, m.d.
3¼" Gridley Single Spindle, m.d.
No. 6D Potter & Johnston, arranged for brake drum work, m.d.
3—No. 22 New Britain, chucking, have tapping spindle
No. 23 New Britain, chucking, tapping spindle
2 No. 33 New Britain, chucking, have tapping spindle

BOLT THREADING MACHINES

¾" Style R Economy Automatic, equipped with Lanco Head
No. 11-S Rickert-Shafer Automatic, m.d., cap. 1" rods up to 36" long
1½" Acme, cone
1¼" cap. American Bolt Heading Machine

HORIZONTAL BORING MILLS

No. 0 Fosdick, 3⅛" bar
4" bar Lucas, m.d.
4" bar double spindle Barrett, m.d., has facing attach.
2¾" bar Sargent Floor Type Horizontal, 16' x 4' floor plate

VERTICAL BORING MILLS

24" Bullard Spiral Drive, turret and side head, lubricant system, thread chasing attach., m.d.
42" Niles-Bement-Pond Car Wheel Borer, facing attach.
48" Niles-Bement-Pond
52" Gisholt, 1 turret, 1 swivel head on rail, m.d.
60" Baush, 2 swivel heads on rail, m.d.

BROACHING MACHINES

No. 4L LaPointe Hydraulic, m.d., 1 year old, equal to new
NEW Cincinnati Milling Mach. Co. Mill Broach, m.d.
No. 2 LaPointe, belt
No. 2 LaPointe of Hudson, belt
No. 3 J. N. LaPointe Double, belt

ENGINE LATHES

18" x 10' Lodge & Barker
18" x 10' McFarland & Nottingham
20" x 10' LeBlond
22" x 16' centers (22' bed) American 100 H.P. Input Super Lathe, geared head, with 100 H.P. D.C. variable speed motor
22" x 18' Niles
24" x 10' Greaves-Klusman
27" x 16' LeBlond, taper
30" x 14' Lodge & Shipley
36" x 10' Putnam
36" x 16' Springfield

MANUFACTURING LATHES

3⅛ x 36" Lo Swing
3 x 80" Lo Swing
9 x 12" Sundstrand Mfg.
11" x 4' Wells Speed
14" x 6' Champion
15" x 6' Automatic Threading, m.d.
15" x 6' Automatic Threading, belt
15" x 6' Harrington Barrel Turning
20" x 16' American Geared Head, arranged for boring
Niles-Bement-Pond Axle Lathe, center drive
Niles-Bement-Pond Car Wheel Lathe, 42 x 96", brand new, m.d.
Niles-Bement-Pond Car Wheel Lathe, 42 x 96", used, m.d.
Niles-Bement-Pond Quartering Machine, m.d.

MILLING MACHINES

No. 5B Heavy Brown & Sharpe Plain, m.d.
No. 4 Cincinnati Plain, m.d., rect. overarm
No. 4B Milwaukee Plain, double overarm
No. 3B Milwaukee Plain, double overarm
No. 2B Milwaukee Plain, double overarm
No. 3B Heavy Brown & Sharpe Plain, m.d.
No. 3 Cincinnati Plain, cone, motorized
No. 3 Cincinnati Vertical, m.d.
No. 2 Knight Vertical, m.d.
No. 5 Jackson Vertical, m.d.
No. 2 Pratt & Whitney Hand, cone
Becker Lincoln Type Mfg., cone
Burr Mfg., m.d.
Carter & Hakes Mfg., cone
No. 10 Fox Mfg.
No. 2, 12 Pratt & Whitney Lincoln Type
18" Cincinnati Mfg., m.d.
18" Cincinnati Automatic Duplex, m.d. (3)
28" Cincinnati Plain Automatic
36" x 36" x 14' Bement Slav, m.d., p.r.t.
4½ x 12" Pratt & Whitney Thread, m.d.
6 x 80" Pratt & Whitney Thread, m.d.

Partial Listing only.
Let us quote on your requirements.

The
EASTERN
MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

. . . IN STOCK

AUTOMATICS

⅞" Gridley Model G, four spindle
1¼" Model F Gridley, four spindle
No. 515 National Acme, four spindle
2½" Cleveland Model A, single spindle

BROACHES

American Hydraulic
Oilgear Hydraulic

DRILLS

Avery Sensitive 3 spindle
Barnes Camelback, 4 spindle
Leland-Gifford Sensitive, P.F., 3 spindle

GEAR CUTTERS

No. 6 Fellows Gear Shaper
No. 5A Lees-Bradner Gear Generator
No. 3 Brown & Sharpe Automatic
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS

22" x 48" Pratt & Whitney Vertical Spindle Surface, Timken Bearing
30" Diamond Face, 84" Table Travel
12" Walker Rotary Surface
6" x 32" Norton Cylindrical
14" x 50" Norton Cylindrical
10" x 72" Brown & Sharpe Cylindrical
No. 1 Cincinnati Univ. Tool & Cutter
No. 70 Heald Internal

LATHES

14" x 6' Lodge & Shipley, c.d.
18" x 8' Lodge & Shipley, c.d.
7" x 52" Fitchburg Lo Swing, g.h.
No. 12 LeBlonde Multicut, g.h.

TURRET LATHES

No. 2 Acme Full Universal, g.h.
No. 2A Warner & Swasey, g.h.
No. 2B Foster, g.h.
24" Steinle, g.h.
No. 6A Potter & Johnston, g.h.
1½" x 9" Acme Ram Type, c.d.
No. 2 Warner & Swasey Ram Type, c.d.

MILLS

54" Colburn Vertical Boring, m.d.
42" Niles Bement Pond Vertical Boring, m.d.
No. 1½A Brown & Sharpe Universal, s.p.d.
No. 2 Cincinnati Plain, s.p.d.
No. 3 Ryerson-Conradson Plain, s.p.d.
No. 12 Brown & Sharpe, c.d.
No. 3 Brown & Sharpe Vertical, s.p.d.
4" Pratt & Whitney Spline

MISCELLANEOUS

No. 1 Lapping Machine
10' x 16' Ga. Ohl Squaring Shear
No. 8 Whiting Comb. Punch & Shear
No. P2 Ferracute Press

PLANERS

24" x 24" x 8' American, m.d.
38" x 38" x 12' Niles, m.d.

RESTORE YOUR WORN MACHINES

by having us rebuild them. We have a complete rebuilding department operated by men thoroughly trained in rebuilding. Your machines are taken down, carefully checked for wear, and worn parts are replaced, bearings and ways scraped and refitted. You'll find when rebuilt by us they'll perform like they did when they were new.

Write, Wire or Phone Us

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
INDIANAPOLIS, INDIANA
44 WHITEHALL STREET, NEW YORK, N. Y.

MOREY
Dependable Used Machines

G & E 48" Gear Cutter
GLEASON 10" Spiral Bevel Gear Gen.
GLEASON 6"-18" Bevel Gear Gen.
HEALD No. 70A Duplex Internal Grinder
HEALD No. 60 and No. 70 Internal Grinder motor drive
INGERSOLL 24" Cutter Grinder
LANDIS No. 3½ Int. Hyd. Race Grinder
AUTOMATIC MACHINE CO. 12"x4' Quick Return Taper and Relieving Type Lathe for manufacturing taps

BULLARD 36" Spiral Drive Vertical Turret Lathe with side head; motor drive; cutting lubricant system; slow-feed attachment.
BLANCHARD #11 Vertical Surface Grinder — 16" magnetic chuck; motor driven
BOTH LATEST TYPE

NATCO C-13 Hyd. Multiple Spindle Drill
ESPEN LUCAS No. 138 Cold Saw —Cap. 12"
ACME 1" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
GISHOLT Precision Balancer
LONG & ALSTATTER Angle Shears
AMERICAN 30"x30"x14' Planer 2 heads, M.D.
POTTER & JOHNSTON No. 6C Semi-Automatic
100 ton Hydraulic Carwheel Press

100 Assorted Milling Machine Attachments
DIVIDING HEADS
Vrtical-Slotting—Rack Cutting
for BROWN & SHARPE—CINCINNATI — KEARNEY & TRECKER — LeBLOND — HENDY — OHIO — ROCKFORD — KEMPSMITH

THIS IS A PARTIAL LIST
Send us your specific inquiries

MOREY
MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

HILL-CLARKE

Modernized

CYLINDRICAL GRINDERS *for* SUPER-GRINDING *and* MICRO-FINISH

SIZES AVAILABLE

10x36	10x72	14x72	16x72
10x50	14x50	14x96	18x96

Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels.

Send for a copy of our catalog "Super Grinding."

HILL-CLARKE MACHINERY CO. CHICAGO U.S.A.

Have you any NORTON grinders you wish modernized and motorized?

HILL-CLARKE MACHINERY CO.

649 WASHINGTON BOULEVARD — CHICAGO, ILL.

MANY TOOLS READY FOR IMMEDIATE DELIVERY

Automatic, 1⅝" No. 55 National Acme.
Automatic, No. 6A Potter & Johnston.
Chuckers, 4½" Gridley "H" 4 spindle.
Chuckers, 7" Baird 6 spindle.
Borer, 3⅞" bar Beaman & Smith horizontal.
Brake, 10' Ohl 255 ton capacity press brake.
Broaches, No. 3 J. N. LaPointe double.
Broach, No. 4 J. N. LaPointe single.
Coiler, ⅝" No. 5 Sleever & Hartley spring coiler Series 326.
Compressor, 550' National 3 cyl. vertical.
Compressor, 1400' Sullivan WN3.
Drill, 20" No. 201 Barnes heavy duty.
Drill, 30" Rich Tool Co., heavy duty.
Drill, No. 430 Barnes 2 way horizontal.
Drill, No. 1 Baush 16-8 spindle multiple.
Drills, Nos. 12 & 12C Natco 12 spindle multiple.
Drill, No. 13 Natco 18-12 spindle multiple.
Drill, 21" Weigel sliding head T.A., M.D.
Drill, W. F. & J. Barnes hydraulic vertical for boring & reaming, 12 spindle.
Drills, No. 15½", 15½D and 15½F Foote Burt.
Gear hobbers, No. 12 Barber Colman.
Gear hobbers, No. 16 HS Gould & Eberhardt type B
Gear cutters, Nos. 3 & 4 Brown & Sharpe.
Gear hobber, No. 1, 8"-10" Lees Bradner.
Gear chamferer, Lipe double spindle.
Gear checker, National Cleveland Model B.
Gear shapers, Z1 (61) & Z2 (624) Fellows.
Grinders No. 2 Cincinnati centerless
Grinders, 10" x 48" to 16" x 36" Landis cylindrical.
Grinder, 10" x 50" Norton cylindrical.
Grinders, Nos. 3 & 13 Brown & Sharpe universal.
Grinder, No. 3 Cincinnati universal.
Grinder, No. 120A Gardner 20" opposed double disc.
Grinder, No. 84 Gardner 24" opposed double disc.
Grinder, No. 15A Bryant internal.
Grinder, 20" x 12" x 50" Safety Emery Wheel Surface Grinder, Cincinnati face milling cutter.
Grinders, Nos. 50 and 60 Heald cylinder.
Hone, No. 211 Barnes vertical.
Keyseater, No. 4 Mitts & Merrill, 2½" x 18".
Lathe, 14" x 19" Fay automatic.
Lathe, 22" x 10' American engine-turret.
Lathe, 24" x 16' Schumacher & Boye.
Lathe, 36" x 16' Putnam heavy geared head.
Lathe, 22" Libby turret 4¼" spindle hole.
Lathe, 24" Gisholt turret 6¼" spindle hole.
Lathe, 26" Libby turret 4½" spindle hole.
Lathe, 28" Steinle turret 8" spindle hole.
Lathe, Melling 6 cylinder crankshaft.
Lathe, 1" x 18" Pratt & Whitney full automatic.
Lathes, 3½" & 4" x 36" Lo Swing.
Miller, No. 4 Cincinnati plain.
Miller, No. 1 Davis & Thompson double end.
Miller, No. 3 Turn millers.
Miller, 48" Oesterlein tilted offset.
Miller, Taft Peirce thread.
Miller, Hall Planetary thread.
Miller, 36" Garvin cam or form.
Millers, Type 10 & 45 Producto-Matics.
Polisher, Divine Model RM-X88 rotary.
Planer, 54" x 54" x 28' Hamilton 3 head.
Punch, No. 1½ Lang & Allstatter.
Punch, Rock River 26" throat.
Rolls, No. 1A Ajax taper forging.
Roll, Waterbury Farrel thread roller.
Roll, No. R-60 Yoder crown fender.
Riveters, Nos. 2A, 5½B & 7B High Speed.
Sand Mixer, Baker Perkins.
Screw driver, No. 61AA Bodine.
Swager, No. 6HS Longelier.
Saws, Nos. 12, 12B, 14 & 17 Higley cold, 4" to 8" capacity.
Saw, No. 15 Lea Simplex cold, 5½" capacity.
Saw, 6" Nutter & Barnes cold, 6" capacity.
Saw, 36" Newton cold.
Shaper, 24" Gould & Eberhardt.
Shaper, 36" Morton draw cut.
Shear, 8" x 8" x 1" Long & Allstatter angle iron.
Threader, ¾" Landis.
Threader, 2" Landis, double head, bolt, pipe & nipple.
Upsetters, 4" Ajax.
Washer, Blakeslee metal.
Wire Machine, ⅜" x 3' Shuster.

Ask for Your Copy of Stock List No. 175

MILES MACHINERY CO., SAGINAW, MICH.

OTT MACHINERY SPECIALS

AUTOMATICS, Brown & Sharpe #00G
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" 8S
AUTOMATICS, Cleveland, ⅞, 1¼, 2 & 2½" Mod. B
AUTOMATICS, Gridley, ¾" Model F, M.D.
AUTOMATICS, Cleveland, ⅝" 4 spdle, cut-off, M.D.
AUTOMATICS, Potter & Johnston #5A & 6A
BORING MILLS, 42" Bullard, 2 Swivel Hds.
BORING MILLS, 42" Gisholt, 1 Turret & S.H.
GEAR HOBBERS, 12 Barber-Colman
GEAR SHAPERS, #7 High Speed, M.D.
GRINDERS, Blanchard #16A, M.D. 30" Mag. Chuck Dial loading
GRINDERS, Heald R. S. 12" Mag. Chuck
GRINDERS, Landis, #1 Universal
GRINDERS, Norton, 14x36" Plain, M.D.
LATHE, Steinle Turret, 24" with 4" & 6¼" Hole through Spindle
MILLING MACHINE, #8 Becker Duplex, M.D.
MILLING MACHINES, Becker Vertical, Model C 30" Rotary table, & Model S. D. 40" R. T.
MILLER & DRILLER, Knight #2
PLANERS, 36x36"x10' Hamilton, 2 Heads, M.D.
PLANERS, 42x42"x12' Ohio, 1 Head, M.D.
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo, #2 & 3 Open Back Inclinable

OTT MACHINERY SALES, INC.
542 Second Ave. — Detroit, Mich.

MISCELLANEOUS MACHINES

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6' Niles Plain Radial Drill
3', 9" col. American Enclosed Head Plain Radial Drill
Oliver Tap Grinder, m.d.
⅝" Shuster Auto. Wire Straightener & Cut-Off Machine, up to 36" long
2-spindle DEMCO High Speed B.B. Drill, hand feed, ⅝" cap.
48" x 48" x 14' Gray Dbl. Housing Planer with 4 hds, m.d.
4' Hammond Sensitive Radial, with tapper, m.d.

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1—No. 30A Brown & Sharpe Grinder, M.D.
1—Landis 20" x 136" Universal Grinder, M.D.

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26" x 14' Bridgeford Geared Head Lathe.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
50" G & E Gear Cutter.
24" Gisholt Turret Lathe, 6¼".
10' Bridgeport Knife Grinder.
20"-24"-32" Shapers.
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater 2" x 20".

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#55 National Acme, 1⅝" Cap. M.D.
#52 National Acme, ¾" Cap. 4 Sp. M.D.

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42" Bausch Vertical, 2 Heads on rail
4" Bickford Horizontal, Single Pulley

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Diamond Surfacek, 16 x 16 x 36" M.D.
Universal Tool & Cutter, 6 x 34"
Acme Universal Tool & Cutter Grinder, 10" x 22"
#2 Norton Universal Tool & Cutter Grinder, 10" x 48"

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Lodge & Shipley, 14 x 6 Q.C.
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14 x 6' Hamilton—Quick Change
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#3 Hendey, Table 13" x 49"
Garvin-Dupdex, Table 12" x 64"
#12 Brown & Sharpe Production
#7 Becker
Becker Vertical, Model AB
#12 Pratt & Whitney Production, 7½" x 42"
Gooley & Edlund Production, 8" x 24"

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Gray, 36" x 26" x 12'. 2 Heads on Rail

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Gould & Eberhardt, 10"
Gould & Eberhardt, 14"
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Kelley, 16"
Robur, 18"
Juengst, 21"
Cincinnati, 24"

TURRET LATHES
Jones & Lamson, 3" x 36" Sp.
Fox Monitor, 1¼" thru spindle
#2A Warner & Swasey
#3A Warner & Swasey
#4 Universal Warner & Swasey
Pratt & Whitney, 1½" capacity

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Form Rolling Machine, 3 Sets of Rollers
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Atkins Hacksaw
Racine Hacksaw
Williams & White #17, Heavy Duty Punch, 36" throat
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Oster Threader
Schatz Angle Shear, 4 x 4 x ⅝"
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#55 Heald Cylinder.
Lees Bradner Gear Grinder.

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18" Gleason Bevel Gear Generators.
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Lees Bradner Gear Grinder.
#3—26" B & S Gear Cutter.
#6 Fellows Gear Shaper, Cullman M.D.
#645 Fellows Gear Shaper, Cullman M.D.

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24"x24x6' Flather, 1 head
24x24"x6' Whitcomb, 2 heads
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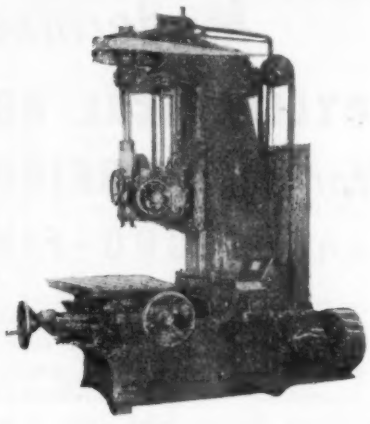

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B. & S. No. 3-26" Cutter
Gleason 11" Bevel
Fellows No. 6, 61 Sharper

BORING MILL

2½" G. & Lewis, M. D.
2½" Binsee
10' Niles Vert. 2 heads
3½" Rochester, M. D.
4", 4½" Gisholt and Niles
54", 60" Colburn, M. D., 2 heads
36" Bausch, Niles 2 heads
42" Bullard, 2 heads
36" Bullard Vtl Turret

LATHES

48" x 26' Niles
48" x 14' B. & Emmes Q.C.
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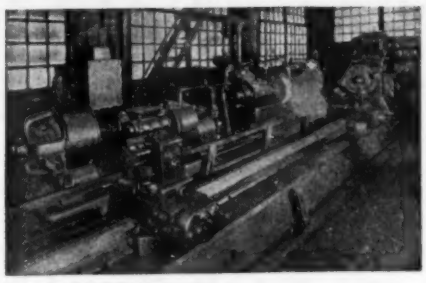
30" x 20' LeBlond Std. chg.
24" x 12' LeBlond, M. D.
26" x 24' Putnam, S.Q.C.

AUTOMATICS

3—Potter & Johnston No. 6A Turret Lathes, M. D.
10—Gridley ¾"—4¼" sgl. and multiple spindles



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Cincinnati No. 5 Plain, M. D.
B. & S. No. 33, M. D.
Milwaukee No. 3 Vert., S.P.D.
Cleveland No. 2 Univ., S.P.D.

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P. & W. 14", M. D., B. B.
Norton 12 x 18", M. D.
Landis 14 x 52", S.P.D.
Modern 12 x 28" M. D.
B. & S. No. 10, 11, 14
Blanchard 26" Surface S.P.D.
Diamond 12 x 36", M. D.

TURRET LATHES

Gisholt 24", 6¼" hole
Gisholt 28", 3¼" hole
Gisholt 21", 3½" hole
Libby 18", S.P.D.
King 34" VTL. Turret
W. & S. No. 3A, S.P.D.
Foster No. 1B, S.P.D.

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1—Elmes 1⅛" x 4" Horiz, 4 plunger pump, 6½ GPM, 5000#, WP.
1—W-F 1000 ton press, 20" ram, 7" stroke
1—W-F High-Low Pump, 60 GPM at 300#, WP., 3 GPM at 6500 High WP
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9" Pratt & Whitney Gear Grinder, M.D.
11" Gleason Bevel gear generator
No. 61 Fellows
Cimatool gear chamfering, M.D.
Lees-Bradner Gear Grinder
Lees-Bradner 6" x 54" spline-Gear Hobber, M.D.

TURRET LATHES

6 x 6½" Goss & DeLeeuw
3¼ x 36" Jones & Lamson, M.D.

MISCELLANEOUS

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2 #2 Avey 2 spdl, Aveymatic Feed
8" Bullard Multimatic M.D.
36' x 36" x 8' Woodward & Powell Planer Rev. M.D.

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Drill, six-spindle Henry & Wright, 12" overhang
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Grinder 60" plate
Grinder #60 Heald, cylinder
Grinder, Sellers Tool
Lathe 14" x 12' Lodge-Shipley grd. hd. s.c. mtr. dr.
Lathe, 24" x 18' Steptoe-McFarlan
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Pelis #13 universal punch & shear
Press #8-7 Zah-Hahnemann straight side grd.
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Punch & Shear, two ½" capacity
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Turret Lathe L & D brass, cross slide turret
Vacuum Cleaner, heavy duty for shop use

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COLUMBUS, OHIO

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LATHE, Turret 34" Gisholt, 4¼" H.S., M.D.
MILLER Plain No. 1 Cincinnati, M.D.
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PRESS, Toggle No. 14 Bliss, stroke 18.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'.
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INGERSOLL 2—8p. Vert. Miller
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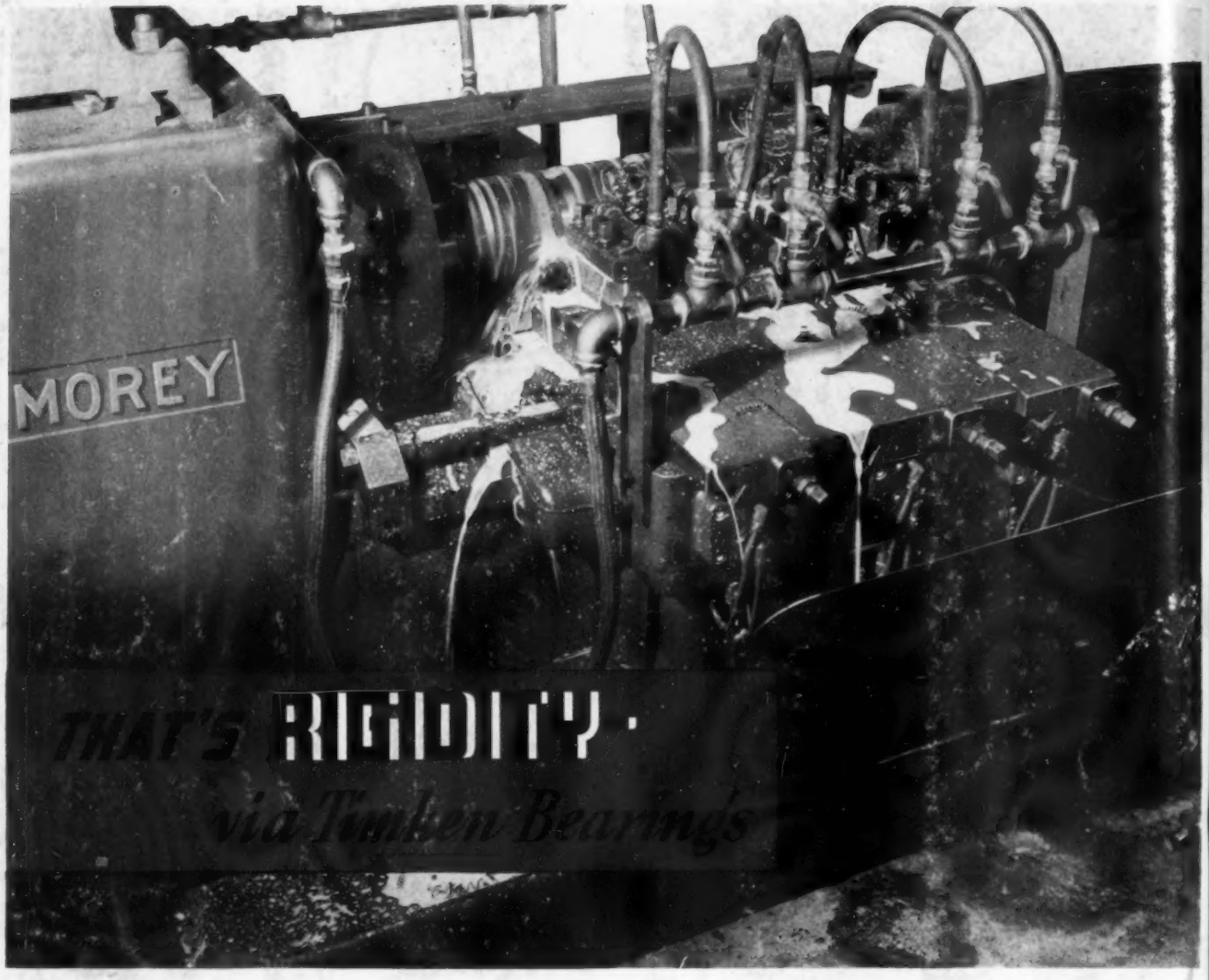

There's never a quiver—never a trace of eccentricity when machine spindles turn on Timken Tapered Roller Bearings. Timken Bearings hold the spindle in a giant's grip —yet with a touch as gentle as a baby's; so in spite of the tremendous rigidity, there is not the slightest interference with rotation—it's free as air, smooth as silk.

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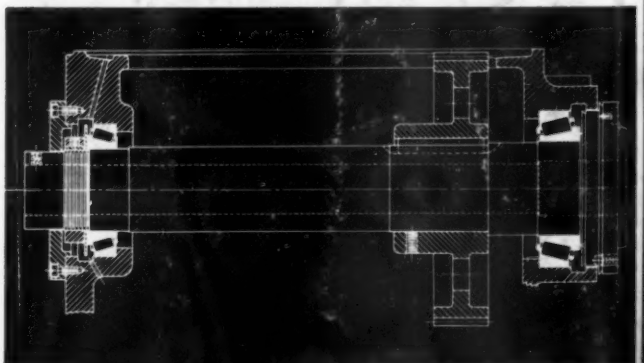
Morey No. 27 Automatic Lathe tooled for turning 155 MM shell. Turning the boat-tail O. D., cutting off to length and facing towards center.



Application of Timken Bearings on the spindle of the Morey No. 27 Automatic Lathe.